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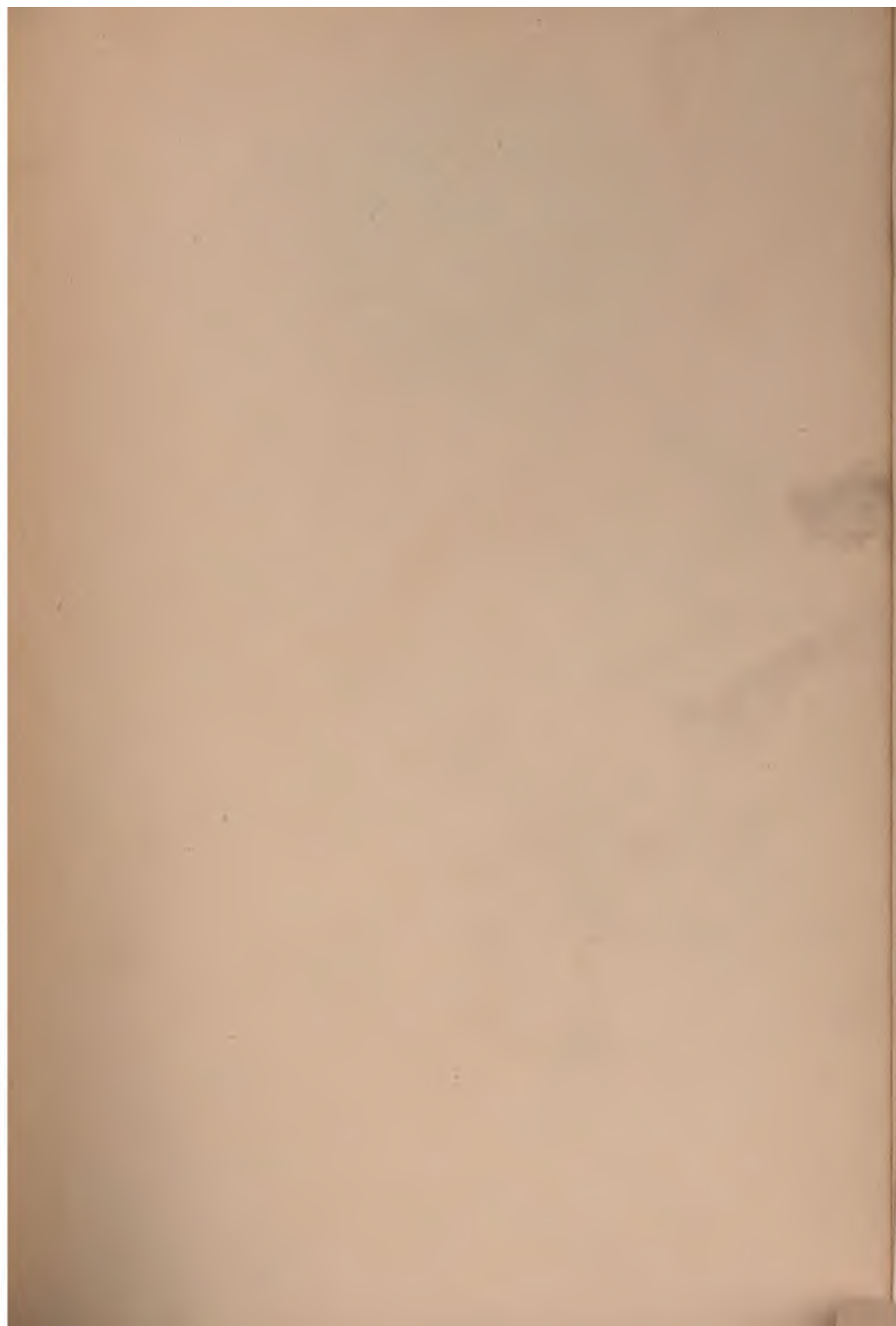
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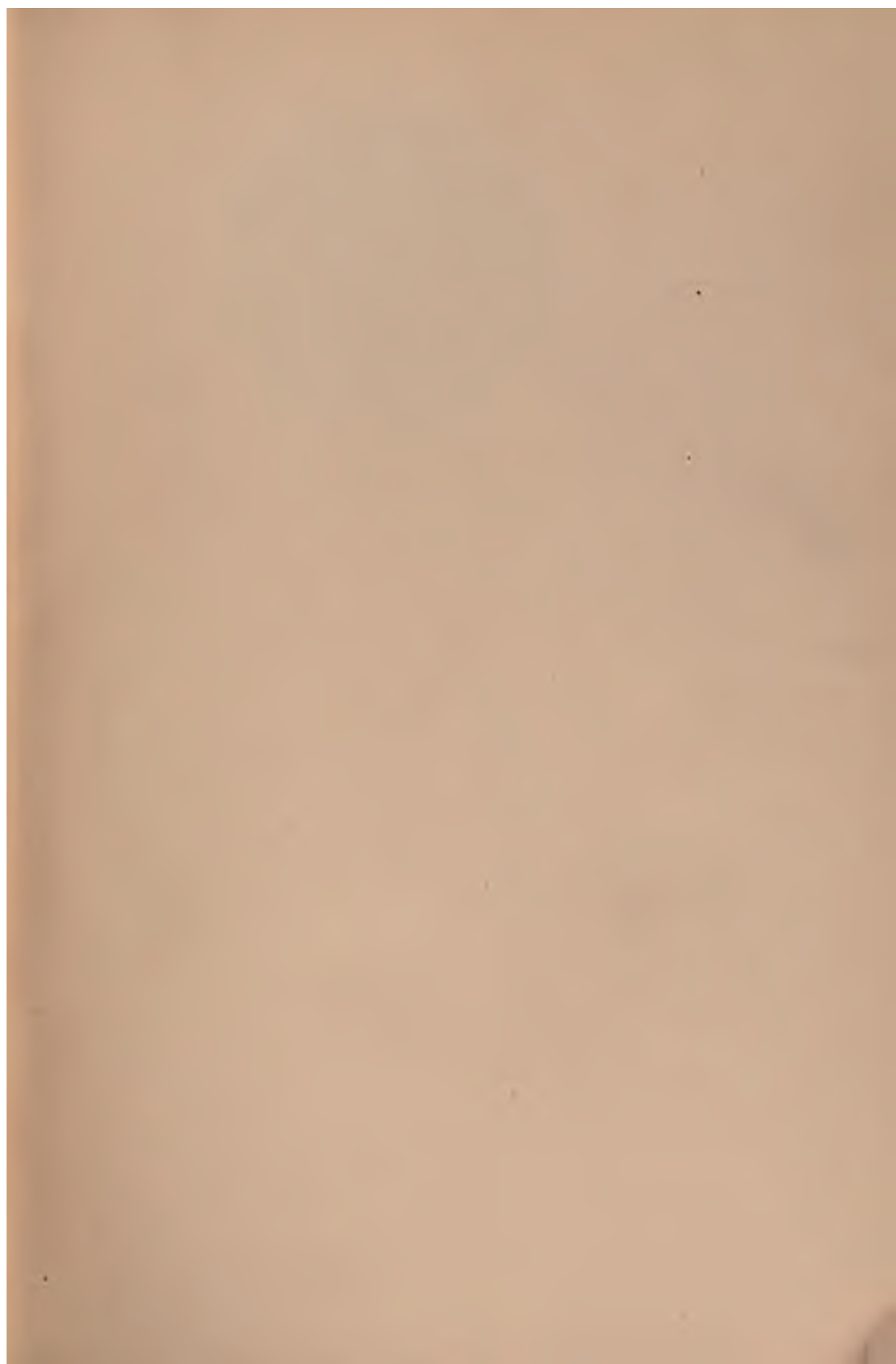
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GYNECOLOGY AND ABDOMINAL SURGERY

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*Illustrated by Hermann Becker
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VOLUME ONE

PHILADELPHIA AND LONDON

W. B. SAUNDERS COMPANY

1907

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PREFACE.

IN the preparation of this work the editors have been continually impressed with the intimate relationship which exists between gynecology and abdominal surgery. Our associates, competitors, and generous critics, the general surgeons, will not deny that the great advances made in the gynecologic field have constituted the very backbone and the marrow of the abdominal surgery of today, and that *pari passu* with the labors of the gynecologists have gone the developments of the surgery of the abdomen at large. These volumes embracing both subjects are living witnesses of the unity of gynecology and abdominal surgery in the practical field, which it is our pleasure to proclaim, as we thus once more assert the unity of our art and the fraternity of those who practise it.

In planning our work the usual classification of the hand-books has been set aside, in order to substitute one of greater practical value to the general practitioner, to the investigator, and to the surgeon.

A considerable section is devoted to medical gynecology, to meet the needs of the general practitioner, who will find the information he requires concentrated in one section, without being under the necessity of searching here and there throughout both volumes.

Certain obstetric or gynecologic-obstetric subjects have been included in our list, such as the puerperal injuries and infections, the treatment of incomplete abortion, ectopic pregnancy, and the Cesarean operations. It is believed that this will prove not only of practical value to the physician, but will give the general surgeon practising abdominal surgery without an obstetric training a broader and fuller view of the subject.

Separate chapters have been devoted to the systematic consideration of the bacteriology and the pathology of the diseases of women. Those wishing to investigate the scientific basis of gynecology will find it suitably set forth in these sections. We believe that no other monograph on pathology as complete as this has as yet appeared in the English language.

Other special chapters have also been written upon subjects usually found only in monographs; such as, operations during pregnancy, operations before puberty, conservative operations upon the uterine appendages, and the complications of operations.

Surgical gynecology and abdominal surgery proper have been broadly and liberally dealt with. We have naturally devoted our especial attention to modern surgical technic, and have been at pains to provide that the operations themselves should be profusely illustrated with fresh, accurate, and graphic drawings.

To prevent the undue expansion of our work, space has been spared by omitting elementary matters found in every text-book.

The historical development of gynecology and abdominal surgery has been carefully treated, showing the prominent part played by American surgeons in these fields.

Concerning the relative advantages of the abdominal and the vaginal route for the performance of various operations there are still decided differences of opinion. Here we have presented the claims of the two schools from the affirmative standpoint, by selecting tried advocates to present each side.

The illustrations have been done by, or under the supervision of, Mr. Hermann Becker, who has devoted more than four years to his work; almost all the drawings are from his hand; some have been made by Mr. Max Brödel, and others.

Three of our collaborators, Drs. Alexander J. C. Skene, Wm. R. Pryor, and Fernand Henrotin, have died during the preparation of this work. We take pleasure in presenting to the profession their last contributions to gynecology.

The work is the first in which the attempt has been made to cover both the fields of gynecology and of abdominal surgery. Its subject-matter has been further broadened by the consideration of medical gynecology, of various practical subjects usually dealt with only in monographs, and also the gyneco-obstetric field. We hope that this will make our work unique in its presentation and in its claims upon the consideration of the profession.

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GYNECOLOGY

AND

ABDOMINAL SURGERY.

CHAPTER I.

GYNECOLOGIC TECHNIC.

BY HOWARD A. KELLY, M.D. .

SURGICAL TECHNIC is an expression used to cover the conduct of the details of any surgical operation. By an **ASEPTIC SURGICAL TECHNIC** we designate the various measures used in the course of an operation to secure freedom from microorganisms which, introduced into the wounds, are liable to act injuriously to the patient and hinder the process of wound repair.

Those points in the technic which are peculiar to an individual operation belong more properly to the description of the operation and will be found there recorded.

A proper appreciation of the principles upon which the technic of aseptic surgery rests is of necessity associated with some knowledge of pathology and bacteriology, and the conscientious surgeon should familiarize himself with the general principles of these fundamental sciences if he would carry out an intelligent, consistent technic. Unless he knows the more common pathogenic bacteria, their habitats, portals of entry into the human organism, their mode of introduction, the lesions they are likely to cause in the human body, their resistance to germicides, etc., he is not likely to cultivate a technic which is above criticism. He must bear in mind, too, that the outcome of a bacterial invasion depends upon a number of conditions relating not only to the particular microorganism under consideration but to the patient as well. Thus, the number of the bacteria and their virulence are probably no more important factors in the issue than the condition of the tissues through which they gain entrance, and the individual powers of resistance to the bacterial invasion. The surgeon must appreciate the necessity of avoiding dead spaces and blood-clots, whenever this is possible, as well as the risks from tissues poorly supplied with blood, etc. Patients weakened by disease, fatigue, intemperance, etc., offer less resistance to infection than the healthy. A wise surgeon also knows that all pus is not equally infectious; he

will strive, too, to distinguish between the lesions caused by the gonococcus and those of the more virulent pyogenic bacteria.

A thorough knowledge of a few of these principles should form part of the equipment of every gynecologist:

SEPSIS, ASEPSIS, ANTISEPSIS.

Sepsis designates the condition produced in the animal organism by the invasion and multiplication of pathogenic bacteria. *Asepsis*, in a surgical sense, is the absence of pathogenic bacteria; an aseptic wound is one which remains free from invasion by these germs in sufficient numbers to disturb the healing process. *Antisepsis* designates any active means by which bacteria are destroyed, removed, or rendered inactive.

The microorganisms most frequently concerned in traumatic or wound infections are the pus-producers, or pyogenic bacteria, the most important of which are the *Staphylococcus pyogenes aureus* and *albus* and the *Streptococcus pyogenes*. The *Bacillus coli communis*, the Klebs-Loeffler bacillus, the *Bacillus anthracis*, and other microorganisms, may also cause wound infection. (See chapter on Bacteriology.)

The conception which once prevailed that a wound becomes infected in much the same way as an artificial culture-medium, *i. e.*, by the mere entrance of the bacteria, has been greatly modified by more careful study of the various conditions associated with the wound infection. There are various circumstances besides the mere presence of bacteria which determine the occurrence and course of a traumatic infection.

The persistence and the multiplication of bacteria in living tissues are resisted by the properties of the cells and juices of the invaded animal organism. The utmost care does not serve to prevent the entrance of some bacteria into almost every wound, and in many surgical operations pathogenic bacteria are present; owing, however, to their limited numbers, their attenuated virulence, and the germicidal properties of the tissues they fail to do any harm. It is to the absence of the more virulent bacteria, as well as to the germicidal properties of living tissues, that we must ascribe the good results often obtained by surgeons in spite of a faulty technic.

It would, however, be an egregious folly to rely exclusively in surgical technic upon the germ-destroying powers of the living tissues and fluids of the body, great as they undoubtedly are and important as it is not to interfere with these natural germicidal agencies. In a large proportion of the cases in which bacteria have been found in the so-called aseptic wounds, they have been either non-pathogenic or possessed of little virulence. It is exceptional to find virulent pathogenic bacteria in wounds without some manifestations of their activity.

The bacteria which give rise to septic disturbances after an operation are imported into the wound, the peritoneal cavity, etc., through the direct agency of

the operator, assistants, or nurses, or through the air; they are derived from the bodies or apparel of the operator and his assistants or nurses; from the body or clothing of the patient; from the dressings, sponges, ligatures, sutures, instruments, water, etc.; the persons of spectators, or the dust in the air of the room.

It is necessary, therefore, in order to secure an ideal technic, that everything which comes into contact with the wound should be sterile; that the skin of the patient should be free from bacteria; that no germs should gain entrance to tissue freshly denuded or into body cavities, which are naturally sterile, from the intestinal tract of the patient or from other septic foci; the air of the operating room should also be free from bacteria. The complete fulfilment of these conditions is, of course, impossible, but we must ever strive for perfection, and we shall be, at least, practically successful.

To accomplish the end all instruments, dressings, protectives, ligatures, sutures, irrigations, gloves, etc., are sterilized; the skin and mucous membranes of the patient in the neighborhood of the site of operation, and the hands and forearms of the operator and his assistants, are rendered as nearly germ-free as possible; the wound and the sterile body cavities are guarded from infection derived from abscesses, the intestinal tract, etc., by protecting them with gauze, sponges, etc., and by subsequent careful cleansing. That the *air* of the operating room is never entirely free from bacteria can be readily shown by exposing an agar plate for a few minutes in the room, when numerous colonies of microorganisms will develop. These bacteria are, as a rule, saprophytic in their nature and cause little or no harm when they lodge in a wound; pathogenic bacteria may, however, be thus conveyed, and the air must ever be considered as one of the carriers of wound infection. Bacteria in the air are conveyed largely by dust, more being in the air in dry and windy weather than when it is wet and calm. The dust of hospitals is more apt to contain pathogenic bacteria than that of private houses; and operating rooms in which there are draughts and where the floors and walls are not kept clean and free from dust are most liable to be sources of air infection. In like manner the air of cities is more apt to convey infection than country air.

Flies and insects are important agents in carrying bacteria; they should be excluded from the room, if possible, and, at all hazards, kept away from the wound and dressings.

Tap water frequently contains bacteria and fungi and, unless sterilized, can convey infection.

The dangers of infection from air and water are believed to be not nearly so great as from other sources.

Assuming that the broad general principles underlying aseptic surgery are understood by the operator, assistants, and nurses, the successful carrying out of the technic depends upon the most painstaking attention to details. Not only must each step in the actual operation be conducted in accordance with these principles, but the preliminary preparation of the patient, dressings, etc., must likewise be faultless. Each individual employed in the operation, or in the prep-

aration of the patient or dressings, etc., must realize that one error may occasion a fatal result. To this end, each one should be so carefully instructed in his or her respective duties that there will be as little confusion during operation as possible and all errors will be avoided. The hands of those coming in contact with the wound or the dressings are rightly regarded as the most frequent source of infection, and as sterilization of the human skin is far from satisfactory, the surgeon and his assistants must constantly realize this source of danger. They must, in the first place, anticipate danger by keeping their hands free from all virulent bacteria by wearing rubber gloves, or using forceps or some similar device in dressing infected wounds, and in examining suspicious cases.

METHODS OF STERILIZATION.

The technic of aseptic surgery depends directly upon the *sterilization* of everything which comes in contact with the wound or body cavity; it is necessary, therefore, at the outset to consider the methods used to render these objects sterile. The methods in use are classified as follows:

1. Mechanical cleansing.

2. Heat	{	Dry	{	Flame.
			{	Cautery.
				Hot air.
2. Heat	{	Moist.....	{	Steam.
			{	Water.
		Intermediate		Alcohol.
				Various oils, etc.

3. Chemical sterilization.

The selection of the method for the sterilization of a particular object depends upon a variety of circumstances, such as the nature and properties of the object to be sterilized and the facilities at hand. For example, although the hot water kettle is such a convenient mode of sterilization, catgut cannot be subjected to the action of steam or of boiling water without rendering it useless, though for silk, silk-worm-gut, and many other objects, there is nothing better or simpler. The hands, however, cannot be boiled, so in their case we must be content with mechanical means of sterilization, or, best of all, protection with rubber gloves. The goal toward which all modes of sterilization strive is some method which will destroy the most resistant of bacteria and spores, and unless this is accomplished, the method is more or less imperfect.

Mechanical Cleansing.—Although we cannot hope to render any object absolutely sterile by mechanical cleansing, it is, nevertheless, a time-honored method and is still one of the most useful ways of securing asepsis. The method embraces the thorough washing of dressings, sponges, instruments, etc., before subjecting them to other more acute forms of sterilization; also the shaving of the skin near the wound, and the scrubbing of the skin of the patient with soap and water, alcohol, ether, etc., as well as the vigorous use of the scrubbing-brush upon

the hands and forearms of the operator, assistants, and nurses; also the washing and scrubbing of clothing, floors, and tables, as well as the walls of the operating room. The shaving and scrubbing of the skin remove not only most of the bacteria present, but, by ridding the superficial layers of the skin of oils and fats, prepare the way for the chemical germicides which follow, and open up an avenue by which they can come into contact with the bacteria which lie concealed. In like manner, were it not for the constant mechanical cleansing of beds, bedsteads, tables, floors, and walls of wards and operating rooms, wound infections would occur much more frequently than is now the case.

Heat.—Heat is the ideal germicide. All known bacteria and the most resistant spores are surely destroyed in a comparatively short time when exposed to a temperature short of that which destroys vegetable fiber. The form of heat used may be flame, cautery, hot air, hot alcohol, oil, steam, or hot water.

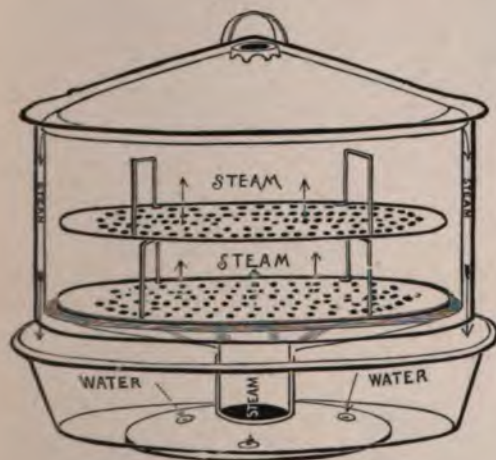


FIG. 1.—ARNOLD STERILIZER.



FIG. 2.—BOECKMANN STERILIZER.

The *flame* is used to destroy debris, septic dressings, tissues, etc., and to sterilize certain instruments. It is a convenient means of sterilizing a needle, knife, or other small instrument, but as it destroys the temper of steel, it cannot often be used for instruments.

The chief use of the *cautery* as a germicide is in sterilizing and destroying septic and necrotic tissues.

Hot air or dry heat is useful in the sterilization of instruments, test-tubes, ligatures, and sutures, as well as dressings, where it is not convenient or feasible to use boiling water or steam. Its chief application is in the preparation of catgut, test-tubes, and dressings. The temperature of dry heat required for the destruction of the more resistant spores is considerably higher than the boiling-point of water, so that vegetable and animal fibers, especially the latter, are liable to be injured by this mode of sterilization.

The application of heat by means of *alcohol* and *oily substances* is of use chiefly in preparing suture material of animal fiber.

Steam is one of the most useful of all methods of sterilization, because it is both easily applied and quite effectual as a germicide. The ordinary bacteria are destroyed by subjection to steam for a short time. Spores, however, sometimes resist the action of steam to a remarkable degree, and it is simply impossible in bacteriologic work to render culture-media sterile by the ordinary fractional (repeated at intervals) sterilizations.

In the order of their sterilizing value the kinds of steam used are the following: (a) quiescent, simple steam; (b) live steam, circulating steam; (c) steam under pressure, where both tension and temperature are greater than with ordinary steam. Live steam is more effectual as a germicide than ordinary steam, but it is incapable of destroying the spores of some bacteria.

The well-known Arnold, Rochester, or Boeckmann sterilizer, or one similarly constructed, can be readily transported and is cheap and effectual. In the Arnold sterilizer the steam, generated in a shallow receptacle containing water

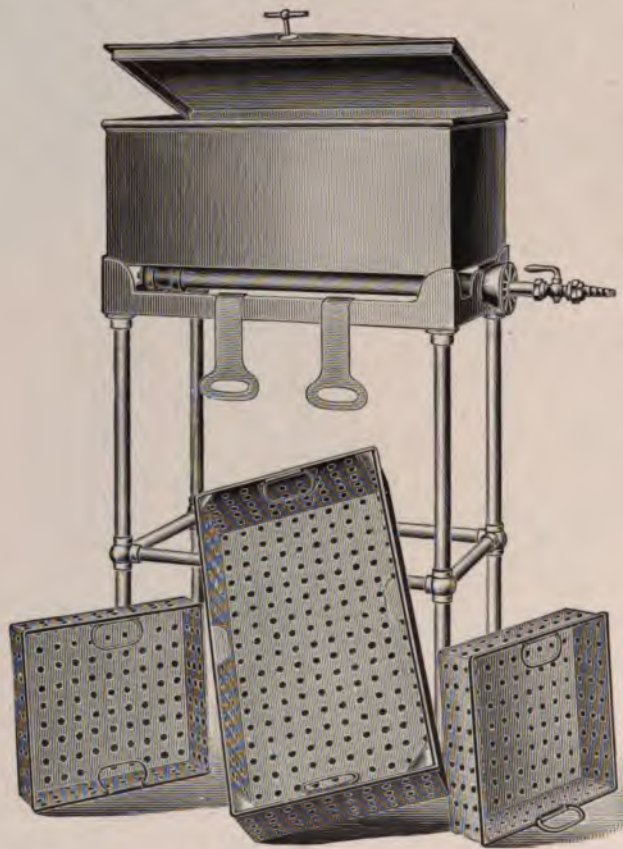


FIG. 3.—INSTRUMENT STERILIZER. ATTACHED TO GAS ON RIGHT; TRAYS BELOW.

by means of a Bunsen burner or a stove, passes through a tube into a chamber containing the articles to be sterilized. This chamber is surrounded by a tin or copper jacket in which the steam condenses after circulating through the inner chamber. The water of condensation then drops back into the receptacle from which it started.

The Rochester sterilizer is somewhat similarly constructed, except that the steam escapes without condensation, and after the articles are sterilized, they can be dried by turning the steam off from the inner chamber while it still continues

to circulate in an outside jacket. In all these sterilizers the articles to be sterilized are subjected to the action of live steam at the pressure of the atmosphere. At a high altitude, where water boils at a lower temperature than 212° F., all forms of sterilizers constructed upon this principle lose in effectiveness.

In hospitals, as well as in private work, where it is available, the use of steam under pressure is always best. Under the atmospheric pressure at the sea-level, steam has a temperature of 212° F., while with an additional pressure of 15 lbs. to the square inch the temperature becomes 240° F. and the generated steam is proportionately more effectual as a germicide. The most resistant spores when subjected to the action of steam at such a temperature are destroyed in fifteen to twenty minutes. In all sterilizers the air in the sterilizing chamber must be replaced by steam, as the former at the temperature of steam is not nearly so germicidal as the latter. All dressings should be thoroughly dried after sterilization, before packing them away for future use.

The Kny-Sprague sterilizer is commonly used in America where steam under pressure is available. It consists of a cylindric chamber surrounded by a steam jacket, and with valves opening into the outside air and into the steam jacket. The steam jacket is partly filled with water, which is heated either by gas jets beneath it or by coils of pipes in which the superheated steam from a neighboring boiler circulates.

Indicators register the pressure of steam and the height of the water; there is also a safety-valve. To use the sterilizer the articles to be sterilized are placed in the central chamber and the heat started. A stop-cock, communicating with the outside air, is then opened so that the air in the chamber is driven out with some escaping steam. As soon as the steam escapes freely from the stop-cock it is shut off, when the pressure in the chamber begins to rise, as indicated on the dial; as soon as it registers 15 lbs. any excess steam escapes by the safety-valve. When

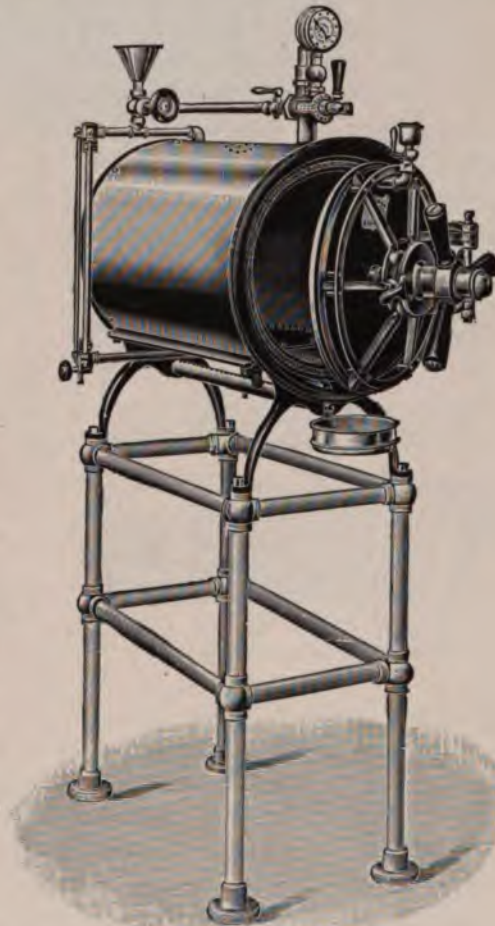


FIG. 4.—STERILIZER FOR DRESSINGS, BASINS, ETC.

the articles have been sterilized in this way for a sufficient time the communicating cock between the outer and inner chambers is closed, the cock communicating between the inner chamber and the outside air is opened, and the articles are dried by the heat of the outer chamber. The only objection to such a sterilizer is its expense.

The following articles are best sterilized by steam: dressings, towels, gowns, silk suture material, silkworm-gut, metal sutures, solutions of salt, boric acid, etc., gauze impregnated with iodoform and other chemicals, infected clothing, metal-ware, and a few articles made of glass. Most glassware, as well as rubber and leather articles, cannot be sterilized without injury, and some solutions, such as cocain, collodion, and others, are injured by it. The dressings and other articles should not be packed too compactly, nor should the individual packages be too bulky, as the steam must come into intimate contact with every part of them. The time required for sterilization depends upon several conditions, as, for instance,

the compactness and bulk of the articles, the amount of pressure, and the resistance of the bacteria present. At a temperature of 240° F. all bacteria freely exposed to steam are destroyed in fifteen to twenty minutes, but to allow for the time required to penetrate dressings, etc., the process should be extended to an hour.

Boiling water is an effectual and convenient means of sterilization and can be used for nearly all purposes where steam is employed. Its effectiveness, with the addition of carbonate of soda, is equal to



FIG. 5.—FISH KETTLE FOR USE IN STERILIZING INSTRUMENTS IN PRIVATE HOUSES.

that of live steam. It is not advisable, for manifest reasons, to use this method for gauze, dressings, clothing, and similar articles. It has the advantage of convenience, for in private practice and in emergency cases it is nearly always possible to obtain a vessel in which instruments, ligatures, gloves, and dressings can be boiled. The addition of 1 per cent. sodium carbonate to the water is sufficient to considerably enhance its sterilizing power when boiling. The soda is supposed to act by dissolving the protective capsule of the spores. The soda solution has the additional advantage of preventing instruments from rusting.

A convenient vessel for boiling instruments is a long, narrow metal vessel resembling a fish kettle, 3 or 4 inches deep, with a well-fitting top. The heat can be applied by means of Bunsen burners, or the vessel may be placed directly on a stove, or over a fire.

As a fixture in the operating room, it is convenient to employ a rectangular receptacle, about 15 inches in length by 8 inches in width and 6 inches in depth, made of sheet bronze, polished on the outside, and coated internally with pure tin over which a coating of nickel is deposited. The cover of the vessel opens in "slip

hinges," and two perforated metal trays serve to hold the instruments in the sterilizer. Water can be turned into and out of the sterilizer, and is heated by steam pipes or Bunsen burners. The instruments are then immersed in a 1 to 2 per cent. solution of carbonate of soda, which is brought to the boiling-point and kept there from five to fifteen minutes.

Chemical Antisepsis.—Chemical germicides, while not so valuable as once anticipated, follow heat and mechanical cleansing on the list, and are necessary to nearly every operation. In combination with mechanical cleansing, the use of chemical antisepsis is still in vogue in the preparation of the skin of the patient as well as the hands and forearms of those who take part in the operation. Chemical agents are also extensively used in the preparation of catgut, kangaroo-tendon, sea sponges, etc. They are, moreover, of great value in the irrigation and cleansing of septic wounds, tending to check or to control decomposition. One of the most valuable fields for their employment is in the disinfection of rooms, beds, bedsteads, furniture, sinks, feces, and sputum. Their value was clearly shown in the early antiseptic period of surgery, but the increasing tendency of our day is to dispense with them. While many of these antiseptics have, under favorable conditions, powerful germicide properties, these properties are so frequently modified by circumstances that, when it is feasible, they should be replaced by heat. Thus, while in experimenting in the laboratory the bacteria may readily be destroyed when directly exposed to the action of the antiseptic, in a surgical operation many things may combine to interfere with such an ideal contact. The bacteria under these circumstances, for example, are frequently protected from the solutions or gases by a coating of oil or fat; again, the very numbers of the bacteria or the quantity of extraneous matter present may hinder the antiseptic from coming in contact with the germs, or, in many instances, chemical combinations are formed with the secretions which render the drug inert.

Chemical antiseptics may be applied as powders, solutions, or gases; the principal drugs in use are the following:

Bichlorid of mercury is one of the most useful in the whole series. It occurs as a white, crystalline, odorless powder, soluble in 16 parts of cold water, in 3 parts of alcohol, and very soluble in ether and the volatile oils. It is a powerful poison and vigorously corrodes steel and other metals,—disadvantageous qualities which, to some extent, restrict its use in surgery. It combines with the alkaline carbonates, albumin, and the earthy substances to form inert precipitates. A mercuric watery solution is said to lose its strength on standing, especially if exposed to light. It is usually handled in small quantities, in tablet form, mixed with ammonium or sodium chlorid.

According to the experiments of Krönig and Paul,¹ mercuric chlorid loses its germicidal properties to a marked extent in the presence of chlorids, bromids, iodids, and hydrochloric acid. These experimenters apparently demonstrated

¹ Krönig, B., u. Paul, Th.: "Die chemischen Grundlagen der Lehre von der Giftwirkung und Desinfektion," Leipzig, 1897.

that the form in which the tablets are generally furnished markedly diminishes the antiseptic value of the drug, and that many other substances, commonly associated with sublimate solutions, such as common salt and salt solution, cause a great loss of power in its bactericidal properties.

Solutions of the strength of 1 part of mercuric chlorid to 500 to 5000 parts of water are those commonly used. The customary strength for the disinfection of the skin, dishes, etc., is 1:1000. The solution should be made with distilled water, or, if that is not feasible, at least with filtered water, for the reasons just given. The addition of some brilliant coloring-matter to the tablets is desirable, to prevent the solutions being mistaken for other substances.

Bichlorid of mercury solutions should not, as a rule, be used in clean wounds, as they produce superficial necrosis of the tissues and thus actually interfere with healing. It is very irritating to all serous and mucous membranes and consequently should not be used in the peritoneal cavity, bladder, or rectum. Poisonous symptoms may occur from the use of bichlorid solutions in the form of wet dressings, douches, or irrigations, and we must ever bear in mind that many individuals have an idiosyncrasy for mercury.

Carbolic acid, so extensively used by Lister and his disciples in the era of antiseptic surgery, is of comparatively infrequent use at the present time in gynecologic operations. It is not so actively germicidal as chlorin, corrosive sublimate, formaldehyd, and other antiseptics, but it has several valuable properties, namely, it permeates oily substances, retains its stability, does not act injuriously on steel, is a good deodorant, causes slight local anesthesia, and is not very expensive. Its disadvantages are an inferior germicidal power, an injurious local action on the skin and other surfaces of the body, and a liability to absorption and the production of poisonous constitutional symptoms, notably affecting the kidneys and producing smoky urine.

Chlorin is perhaps the most powerful chemical antiseptic used in surgery, but owing to its excessively irritating, poisonous properties its use is largely restricted to the disinfection of feces, sinks, urinals, etc. It is used in some clinics for hand and skin disinfection, and it would be much more generally used were it not for the dermatitis which it sometimes causes. The gas is usually liberated from chlorinated lime or hydrochloric acid by chemical action, and may be allowed to act directly on the skin or article to be disinfected, or it may be applied in the form of chlorin water. Owing to the extreme irritation which it produces when it comes in contact with the conjunctiva and the respiratory tract, the preparation of the gas should take place under a hood.

Formaldehyd.—This gas or its solution in water (formalin) is a powerful germicide, only slightly poisonous to man. As a germicide it is estimated to be as efficient as corrosive sublimate; and its volatility makes it available for purposes for which the latter is not suited. It is used either as *formalin*, containing 40 per cent. of the gas, or the gas is obtained by heating *paraform*, a solid polymer of formaldehyd. Formalin is thought to be a more efficient germicide than the gas,

and is used in diluted form for the sterilization of catgut, instruments, clothing, etc. The gas is principally used for the disinfection of furniture and rooms, and is the most efficient germicide for this purpose which we possess.

Permanganate of potash, oxalic acid, lysol, creolin, salicylic acid, and boric acid all have their uses in the technic of aseptic gynecology. Permanganate of potash and oxalic acid are used chiefly in the disinfection of the hands. The remaining substances are used mainly for washes, douches, and irrigations.

Hydrogen peroxid, at one time most popular in the treatment of suppurating wounds, is still used to some extent. Its germicidal power is probably feeble, but as a deodorizer and cleansing agent for foul and suppurating wounds it is valuable. A vigorous ebullition of gas takes place when it comes in contact with pus or blood, and when applied in a cavity with a small outlet the pressure generated may break loose adhesions which shut off the general peritoneal cavity and thus do harm. Accidents of this sort have actually occurred. The strength of the watery solution commonly used is 3 to 5 per cent. It is frequently combined advantageously with mercuric chlorid or other germicides.

Alcohol is a valuable preservative agent with slight germicidal properties. Its chief use in gynecology is to preserve and harden pathologic specimens as well as to prepare the hands of the operator and his assistants, and the skin of the patient before operation. By hardening the tissues it serves to fix the cells in the superficial layers of the skin and thus prevent their being rubbed off during operation. Dilutions of 50 to 70 per cent. are supposed to have greater bactericidal properties than absolute alcohol.

Ether is chiefly used in removing the oils of the skin, and the water and oils in catgut, thus preparing the way for sterilization.

Salt solution, or a solution of sodium chlorid in distilled water of the strength of 0.6 per cent., is not actively germicidal, but is one of the most useful agents which we possess in combating sepsis, in irritating wounds, serous or mucous surfaces, and in repleting the circulatory system which has suffered a loss of blood. It is prepared by adding 6 grams of pure sodium chlorid to 1 liter of distilled water. The solution is filtered and sterilized either in the autoclave or by fractional sterilization, and is preserved in Florence flasks whose necks are stoppered with non-absorbent cotton covered with gauze, the latter being securely tied beneath the flange of the neck.

For mechanical irrigation of clean wounds, serous or mucous membranes, salt solution is of great value. Being non-irritating it can be used freely in wounds and in the peritoneal cavity, where even considerable quantities may be left in the expectation of a rapid absorption in cases of the loss of much blood. The saline solution is likewise useful in dissolving blood-clots and in cleansing blood-stained tissues during an operation. It is used with very great benefit, either intravenously or subcutaneously, in the treatment of shock, hemorrhage, sepsis, and other untoward conditions arising during an operation.

A number of antiseptic powders are used in gynecology, the chief of which are

iodoform, boric acid, calomel, oxid of zinc, subnitrate and subiodid of bismuth. These are used as dusting-powders, in ointments, or impregnated in collodion or gauze. Of these, iodoform, subnitrate of bismuth, and boric acid are the most used.

Iodoform is a light yellow powder of peculiar odor; it is soluble in ether, alcohol, chloroform, in certain oils and fats, but not in water. When applied to a foul wound it is supposed to undergo a partial decomposition, iodine being liberated. It was thought at one time to be actively germicidal, but recent investigations seem to disprove this. On account of its apparent lack of germicidal power, of its disagreeable odor, and the fact that it occasionally produces symptoms of poisoning, its use is growing more restricted. Its principal use now is in making iodoform gauze, but it is also used when mixed with boric acid as a dusting-powder to wounds or incorporated in collodion.

Boric acid is slightly germicidal and is largely used as a dusting-powder and in solution for irrigating. It is not at all irritating to mucous membranes and is not poisonous.

The *subnitrate* and *subiodid* of bismuth are used somewhat extensively as powders and impregnated in gauze as tampons and drains.

Ointments are seldom used in operative gynecology but are, at times, useful to protect the skin or mucous surfaces from foul or irritating discharges.

Sterilization of Water.—Water is sterilized by boiling under pressure or by fractional sterilization. As it is desirable to have it free from foreign matter, it should be either filtered or distilled, preferably the latter. Filtering does not free it from the salts which are in solution. In private practice, away from hospitals, it is impracticable to carry out the ideal methods of sterilizing water, and it suffices to boil it in a clean vessel for one hour shortly before the operation. A portion of the boiled water is then allowed to cool, and it can be transferred to other vessels by means of a sterile cup or dipper. In hospitals covered vessels are used in which water is boiled and in which the water is allowed to remain until used.

A convenient method of sterilizing water for hospital use is by means of two copper reservoirs, each holding 60 to 70 gallons and heated by gas jets or a steam coil. The water from the tap is first filtered and then boiled for one hour under pressure, when the water in one reservoir is allowed to cool. Gauges show the height of the water in the reservoirs, and thermometers register its temperature. Air filtering valves on top of the cylinders provide for the entrance of pure air as the water is withdrawn. A number of sources of contamination are present in these contrivances,—for instance, the water in the glass gauges is not raised to the boiling-point on account of the want of free circulation, and unless this is remedied each time by allowing the boiling water to flow in and out of the tube, it is a focus from which bacteria contaminate the whole supply. Another source of contamination is the escape pipe. An attempt to sterilize this should be made by allowing several gallons of the boiling water to flow out of the pipe prior to use. The escape pipe can then be covered with sterile gauze.

To be rendered absolutely sterile and to remain so until used, water should be prepared as described for salt solution in flasks which are stoppered with absorbent cotton. The flasks are kept in a place free from dust until needed.

Sterilization and Preservation of Instruments.—No part of aseptic surgical technic is more important than the sterilization of instruments. To facilitate cleansing, a preference should be given to the simplest form of instruments. Joints, corrugations, and rough surfaces on the handles should be avoided as much as possible, and, when feasible, the instruments should be made of materials which allow sterilization by boiling. The locks of scissors, forceps, clamps, etc., should be constructed so that the halves can be readily separated and be cleansed. After operations the instruments are first scrubbed, and then boiled, wiped dry, polished if necessary, and finally rubbed with a cloth containing a little vaselin, to prevent rusting.

Before every operation the proper instruments are selected and wrapped in a towel for sterilization. They are then boiled fifteen minutes in a 1 per cent. carbonate of soda solution. Needles are wrapped separately in gauze. The blades of knives are wrapped in absorbent cotton and the knives are boiled five minutes. After being lifted out of the sterilizer the soda is washed out by pouring sterile water over the instruments, which are then placed in a dish containing warm sterile water.

Only the hands of the operator and his assistants should touch the instruments after they have been boiled. When an instrument has been contaminated it should be washed and resterilized. For this reason it is desirable to have duplicates of many of the necessary instruments ready for the operation.

Rubber tubing, rubber gloves, glass and rubber catheters, can be sterilized by boiling in the same manner as instruments. The flexible urethral catheters, which are made of silk and coated with varnish, are sterilized by washing in a bichlorid of mercury or formalin solution and are boiled two minutes just before

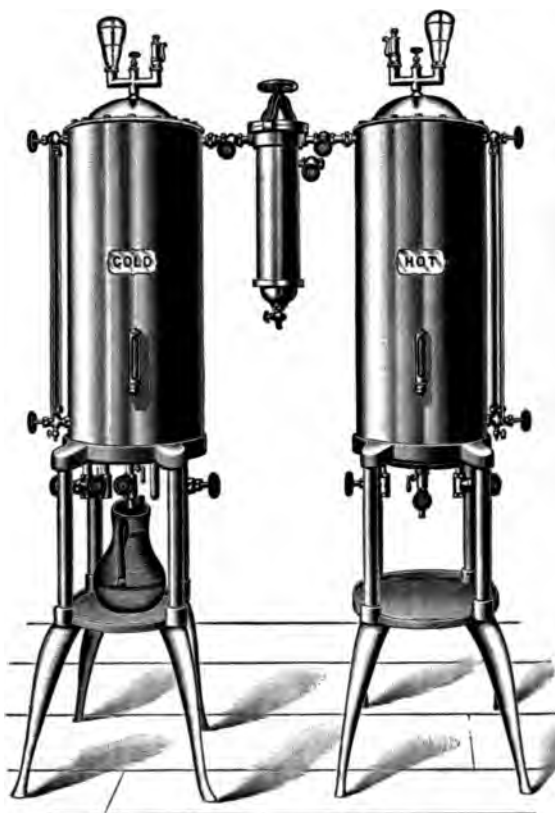


FIG. 6.—HOT AND COLD WATER STERILIZER.

using, as prolonged boiling renders them useless. On account of this imperfect method of sterilization it is safer to discard a catheter after it has been used in a septic case. The experiments of Nancrede and Hutchings show that it requires two minutes' boiling to sterilize catheters which have been infected with the pyogenic cocci, and four and a half minutes when the bacillus coli communis or bacillus pyocyaneus were the infecting organisms. Bichlorid of mercury and formalin sterilization was found unsatisfactory.

Ligatures and sutures are made of silk, silkworm-gut, catgut, kangaroo-tendon, silver wire, and horsehair.

Catgut and kangaroo-tendon approach the ideal suture and ligature material, as they are absorbed by the tissues in a comparatively short time and, therefore, are less likely to cause troublesome sinuses and suppuration. The great objection to their use is the difficulty met with in their sterilization.

Silk, silkworm-gut, silver wire, and horsehair, on the contrary, are not absorbed, or at least very slowly, and in a certain number of cases, when buried, either become infected and cause abscesses and sinuses, or, by the irritation and pain they set up, create the necessity for their removal. This group has the advantage of being more easily prepared, more readily and firmly tied, and these advantages along with their smaller bulk are the reasons why many surgeons use them largely, to the exclusion of absorbable sutures.

Silk in several sizes is still needed in gynecology. The best quality of surgeon's twisted silk is used. The common sizes are Nos. 1, 2, 2½, 3, 4, and 5. The fine silk is used in suturing delicate structures like the bile-ducts and ureters and for ligating small vessels. The Nos. 2 and 2½ are used for ligating vessels, suturing, and making carrier loops for needles. The larger numbers are used in ligating large blood-vessels, pedicles of tumors, and to serve as tractors.

A convenient method of preparing the silk for use is to wind it on glass spools either in one long piece or cut into convenient lengths (10 to 15 inches). Several of these spools are placed in a heavy glass ignition tube, the tubes are loosely plugged with non-absorbent cotton, which is in turn held in place by a piece of gauze tied beneath a flange on the tube near its mouth. The silk is sterilized in the usual manner by steam. The tubes after sterilization should be dried and kept in a clean, dry place.

If it is necessary to remove but one spool of silk from the tube, the gauze is taken out, the cotton plug carefully lifted without touching the mouth of the tube, and upon tilting the latter the spool rolls out. The plug is then replaced until another spool is needed. After the day's work the tubes so opened are safest when refitted with the gauze coverings and resterilized. When subjected to more than one sterilization, however, silk is liable to lose somewhat in strength. Black silk is convenient for intestinal sutures and for ligating small vessels. A strong objection to the use of silk as sutures is its capillary action, by means of which infection may be carried from a surface deep down into tissues previously sterile.

Silkworm-gut is largely used, especially in closing wounds. It is stronger than catgut, is non-absorbable, becomes pliable when placed in hot water, and its smooth, homogeneous surface renders it less liable than silk to convey infection along the suture tract. It is prepared by twisting a dozen or more strands into a bundle, which is placed in an ignition tube, and sterilized like silk. Like silk it may be boiled again before using. It has been found unsuitable as a buried suture and practically abandoned.

Silver wire is used in a number of clinics for closing external wounds. The antiseptic properties of silver, although feeble, undoubtedly exercise an inhibitive action on the growth and multiplication of bacteria. This is a recommendation for its employment, and many of its advocates claim that even if the wound suppurates, the sinus will heal without the removal of the silver. Clinical experience shows us that many silver sutures have to be removed either because of the persistence of a sinus or because of the irritation and pain associated with their presence. Two or three sizes are used. The wire is sterilized by boiling. The heavy sizes are fastened by twisting. I have found a light size, which can be tied like a thread, valuable in fine plastic work.

Horsehair is seldom used in gynecology. It is cut into proper lengths and then washed with soap and hot water and rinsed with alcohol. It should be subjected to steam sterilization before using.

Catgut, when sterile, strong, pliable, and not too readily absorbed, approaches the ideal suture and ligature material. Applied as a ligature or suture it fulfils its mission in the tissues and is then absorbed. It is this absorption or disappearance in the tissues which renders it so valuable, for when catgut is used there is no foreign substance left in the wound to cause a persistent fistula or to demand subsequent removal in consequence of irritation and pain. The objections to its use, however, are several, viz., it is weaker than silk or silkworm-gut, and a larger suture must be used, which unfits it for very fine work; it is more liable to slip in tying than silk, and consequently in ligating large vessels, and pedicles of tumors, or in approximating elastic and resistant surfaces, as after the removal of an interstitial fibroid tumor, there is more danger, in the hands of a neophyte, of secondary hemorrhage. Several sizes are employed and are numbered by the dealers from double zero, the smallest, to No. 4, which is very large. The sizes most used are Nos. 1, 2, and 3. Before using catgut it should be slightly moistened to make it pliable, but not enough to swell it out.

The *sterilization of catgut* is so difficult that many methods have been devised, all of which are more or less unsatisfactory. Two conditions must be fulfilled in order to sterilize it effectively; several other conditions ought to be met, if possible. Let us look at them:

(1) The catgut must be *absolutely sterile* and (2) it must be strong and pliable. After meeting these conditions an ideal method of catgut preparation ought to try also to meet these as well: the method should not take too much time and close attention; the gut should not be swollen; it should be possible to keep it in a

form easily transportable and not readily contaminated, and it should be free from any poisonous or irritating substances by-products of sterilization.

The various methods of catgut sterilization depend upon the application of heat and chemicals. The great problem in applying heat is not to impair too much the strength of the gut. Chemical sterilization is extremely uncertain, and no method of the kind has yet been discovered which is beyond criticism, so far as its germicidal properties are concerned. A combination of heat and chemicals is used by some operators, but these methods are, as a rule, open to the same objection. Catgut cannot be boiled in water or subjected to steam sterilization without having undergone previous hardening, when it is apt to be spoiled. The bacillus anthracis, the spores of which are very resistant, has been found in catgut, and a few cases of infection have been caused by this dreaded organism. Boiling for a few minutes does not with certainty destroy these spores, when they are lodged in the interior of larger sizes of catgut. Boiling in alcohol at a temperature of 212° F. also will not with certainty kill all spores; hence such methods are to be reckoned unreliable. The most efficient methods of applying heat are two in number, viz., (1) by subjecting the catgut to dry heat; (2) by the use of oily substances with a boiling-point higher than water. In both these methods it is absolutely essential, in order to preserve its strength, that the catgut should be thoroughly dried before subjecting it to a high temperature.

The Dry Heat Method.—This method, which was originated by Reverdin, has been extensively used and fulfils the first condition, *i. e.*, it renders the catgut certainly sterile. The difficulty is in applying the heat so as not to render the catgut unfit for use.

It consists in heating the catgut slowly in a dry air sterilizer to 150° C., and keeping it at this temperature for two hours. The method requires close attention in regulating the heat, and the catgut is not as strong and pliable as that sterilized by the *cumol method*.

Krönig's Cumol Method.—The following description is quoted from Miller:¹ "The cumol method of catgut sterilization, first used by Krönig and modified by Clark and Miller, proved to be perfect as regards its germicidal properties, and, when properly carried out, gave strong, pliable catgut. . . . Cut the catgut into desirable lengths, 35 to 40 cm., wind it into small coils or rolls each containing eight to ten strands (it should not be tied, or only loosely). It is then heated slowly (at least two hours) to 85° C. in a dry air sterilizer and kept at this temperature, approximately, for two hours. After thorough drying, it is placed immediately in a metal vessel containing cumol (which should cover the catgut) and this is heated over a sand-bath to 165° C. and kept at this temperature for one hour. The cumol is then decanted, and the excess left in the catgut is evaporated by leaving the vessel over the sand-bath for one hour longer, the flame having been removed. The rolls of catgut are then placed in wide-mouthed, sterile test-tubes,

¹ Miller, G. Brown: "The Sterilization of Catgut," Johns Hopkins Hospital Bulletin, Sept., 1900, vol. xi, No. 114, p. 225.

a few rolls in each tube, and these are kept in a covered vessel for use as desired. A convenient apparatus for the cumol sterilization has been devised by Clark. The principal points to be observed are as follows: the catgut must be perfectly dried before subjecting it to the high temperature of boiling cumol, and care must be taken that the vapor of cumol, which is heavier than air, does not come into contact with the flame or red-hot metal. If catgut is not perfectly dried it will become brittle in boiling. To prevent the cumol from taking fire the sand-bath must be a wide one, extending at least 3 to 4 inches beyond the flame on all sides, and the vessel containing the cumol should have a tightly fitting top with a corked opening for the thermometer, and an escape tube, by means of which the gaseous cumol can be conducted away from the flame. Any device by which the vapor is prevented from rolling over the sides of the vessel will answer. It is well to place the catgut before drying in a suitable wire basket and surround it with filter paper. The basket with its contents is transferred from the drying apparatus to the cumol. This device prevents the catgut from coming in contact with the sides of the vessel. The method of cumol sterilization has been used for five or ten years in the gynecologic department of the Johns Hopkins Hospital with perfectly satisfactory clinical results. The objections to its use are the time and care required in carrying it out. The cost is relatively small, as very little cumol is lost each time and the liquid can be used repeatedly.

"The No. 3 catgut is completely absorbed in the skin in ten days, and loses much of its strength in six to seven days. For ordinary purposes this time is sufficiently long, but in the closure of herniæ, abdominal incisions, etc., a longer time for its absorption is desired. I have taken advantage of the well-known fact that catgut soaked in formalin requires a longer time for its absorption to overcome this difficulty. The No. 3 catgut is soaked in a 4 per cent. formaldehyd or a 1 per cent. formalin solution for eight hours; it is then washed several hours in running water, dried and sterilized by the cumol method. Catgut so treated is as strong as ordinary catgut and rougher on its surface, which is no objection in tying. I have tested the time required for its absorption in a large number of cases during the past eight months and find it to be from fourteen to eighteen days. . . . My method is to take the large rolls of catgut as they come from the dealer, cut the threads which bind them, place them on a cylinder, which they fit loosely, and soak them in formalin. After ten hours they are removed from the formalin and placed in running water for ten to twelve hours. They are then wound in a loose, wide, gauze roller bandage and dried in the sun, or before a hot air draught. The process after that is the same as described in the cumol method."

Perhaps the simplest and most satisfactory method of sterilizing catgut is that devised by Bartlett.¹ This method yields a beautiful reddish-amber, somewhat elastic, strong gut. The method of preparation is free from danger, as the albolene

¹Bartlett, Willard: "A Simple Heat-method of Sterilizing and Storing Catgut," Preliminary Report, Interstate Med. Jour., 1905, vol. xii, p. 270.

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stands the high temperature necessary for the sterilization, 160° C. (320° F.), without the formation of any of those explosive gases which make the cumol method dangerous, and call for the most extreme care throughout with the constant assurance that the apparatus is in a perfectly satisfactory condition. Bartlett thus describes his method:

(1) "The strands are cut in convenient lengths, say thirty inches, and made into little coils about as large as a silver quarter. These coils in any desired number are then strung like beads on a thread, so that the whole quantity can be conveniently handled by simply grasping the thread.

(2) The string of catgut coils is dried for one hour at a temperature of 180° F. and then for a second hour at 220° F., the change in temperature being gradually accomplished.

(3) The catgut is placed in liquid albolene, where it is allowed to remain until perfectly 'clear,' in the sense that the term is used in the preparation of histological specimens. This is usually accomplished in a few hours, though it has been my custom to allow the gut to remain in the oil overnight.

(4) The vessel containing the oil is placed upon a sand-bath and the temperature raised during one hour to 320° F., which temperature is maintained for a second hour.

(5) By seizing the thread with a sterile forceps the catgut is lifted out of the oil, and placed in a mixture of iodine crystals, one part, in Columbian spirits (deodorized methyl alcohol), one hundred parts. In this fluid it is stored permanently, and is ready for use in twenty-four hours; the thread is then cut and withdrawn.

It seems to me important that the gut should be thoroughly 'cleared' before the oil is heated, in order that we may thus be certain that the temperature of the center of the strand becomes as high as that of the oil outside. It may be noted further that I do not remove the oil from the gut before placing it in the storing solution. This is done purposely, since catgut which is perfectly free from oil is so very sensitive to the action of water that it readily untwists and becomes tangled after it is used in a wound but a few moments. This storing fluid simply takes off enough oil from the exterior of the strand so that it is not too slippery for use, and the albolene being a bland, non-irritating substance, there is no reason why it cannot be safely left in the gut. The iodine rapidly permeates the strand; the same will be found stained black after a few hours, and consequently the surgeon will have the assurance that he is introducing an antiseptic as well as a thoroughly sterile suture material."

Another method of causing catgut to resist absorption is by chromicizing it. The method of preparing chromicized catgut is as follows: The catgut, after having been freed from fat by being washed in ether, is treated to a bath of a 4 per cent. aqueous solution of chromic acid, in which it remains twenty-four hours. It is then sterilized according to the method in use at the particular clinic. Catgut so treated is absorbed in from three to six weeks. Some observers claim, however,

that the chromic acid causes irritation and perhaps necrosis of the tissues in its neighborhood and that the catgut in consequence causes trouble.

Kangaroo Tendon.—The tendon from the tail of the kangaroo is largely used and makes an admirable suture material. It is stronger than catgut and less apt to come untied. Many surgeons use it almost exclusively in closing celiotomy wounds and in approximating the fascia and muscles in operations for hernia. Like catgut, the chief objection to its use is the difficulty in sterilizing it. It is less apt than catgut to contain resistant spores of pathogenic bacteria, and anthrax spores which occur in catgut are, perhaps, never found in kangaroo tendon. Marcy,¹ who originated this form of suture, uses the tendon from the tail of the small kangaroo. The tendon, which is taken when the animal is killed, is dried in the sun and kept dry until sterilized. He then softens it in 1:1000 bichlorid of mercury solution, after which he separates and selects the tendons. These are then soaked in a 2 per cent. formalin solution, chromicized, and preserved in a carbolic sterilized linseed oil. When used, the carbolic acid is removed by soaking the tendon half an hour in a warm mercuric chlorid solution. It is quite expensive, and this, together with the unreliability of the method of sterilization, prevents its more general use.

Surgeon's gauze, or cheese-cloth, is largely used as dressing for wounds, tampons, or drains, and as sponges or pads to use during operation. As dressings for wounds it is cut into convenient sizes and made into parcels of several layers in thickness. The gauze tampon, or drain, is made of various lengths and widths, and is frequently impregnated with iodoform, subnitrate or subiodid of bismuth, bichlorid of mercury, carbolic acid, or other chemicals. When used as sponges or pads the gauze is folded into sizes to suit the operator, and the edges can be sewed, or left so that the gauze can be unfolded.

Practically the only chemical impregnated into gauze in gynecology is *iodoform*. The manner of preparing iodoform gauze is as follows:

Iodoform Gauze.—A half pound of iodoform powder is mixed with 4 ounces of glycerin. Two liters of thick soapsuds, prepared from Castile or some other pure soap, and the glycerin and iodoform are stirred together. The rolls of gauze, which have been previously moistened in a weak sublimate solution, are saturated with the iodoform mixture and sterilized by steam. The corrosive sublimate in the gauze apparently prevents the decomposition of the iodoform when it is sterilized.

Absorbent cotton, or common cotton cleaned and deprived of its oil in order to render it absorbent, is largely used in gynecology for the purpose of absorbing discharges, and as a filter when applied to protect wounds. It is also used to protect and pad bony prominences, to fill out depressions in the abdomen and elsewhere, and to make pressure over rather large areas. Cotton covered with gauze

¹ Marcy, Henry O.: "Kangaroo Tendons," Transac. Amer. Assoc. Obstet. and Gynecol., Phila., 1891, vol. iv, p. 185.

is also used to keep the intestines out of the field of operation and to protect them from infection when septic cavities are opened. These pads are made into various sizes and shapes according to the ideas of the individual operator. Cotton covered with gauze is, at times, used as a substitute for sea sponges, and pledgets of various sizes are used for making applications, as well as for taking up fluid in cavities, such as the bladder or kidney.

Towels made of rather coarse and inexpensive material are used in large number, both for protecting the field of operation, instruments, dressings, etc., and for the hands of the operator, assistants, and nurses. For the purpose of keeping the immediate field of the operation aseptic they are extremely useful, as they can be much more readily changed than sheets. For the purpose of sterilization they are conveniently made into packages of six to twelve and placed in a cover made of heavy cotton cloth, in which they may be kept until used.

Silver foil, on account of its non-irritating and mildly aseptic qualities, is valuable as a protective dressing to clean wounds as well as to superficial raw surfaces. It is sterilized either by steam with the dressings, or by dry heat.

Collodion is used by many persons to form an occlusive dressing. The solution should contain an antiseptic, as collodion cannot be sterilized by heat.

Bandages.—The *Scultetus*, the binder, the T-bandage, and the roller bandage are all used in gynecology.

The *Scultetus bandage* is made of six canton flannel strips, four of which cross the abdomen, and two of which are perineal straps. The abdominal straps are sewed parallel, slightly overlapping each other, and are placed at right angles to the perineal pieces. Each piece is 4 inches wide and from 30 to 40 inches long, according to the size of the patient. In putting it on, the body of the bandage goes behind, with its lower edge about on a level with the head of the femur. Beginning at the top, the first strap is drawn firmly, without wrinkles, obliquely down across the abdomen. The next strap overlaps this, and so on to the lowest, which is bound straight across. The perineal straps are then drawn up and the whole secured with a few safety-pins.

The *binder* is simply a piece of cotton cloth from 1 to 2 feet wide and is secured by safety-pins around the abdomen.

The *T-bandage*, which is used for perineal cases, consists, as its name implies, of two straps 3 to 4 inches in width attached at right angles to each other, one of which goes around the waist and the other across the perineum.

The *roller bandage* is chiefly used in breast and hernia operations and is made of gauze or cotton cloth. Plaster-of-Paris impregnated in the meshes of the gauze is frequently used to immobilize the parts.

Large sheets made of heavy cotton cloth, with openings for exposing the wound, are convenient for securing an aseptic field in the neighborhood of the incision. In perineal cases a similar sheet, with stocking-like arrangements for the feet and legs of the patient, is frequently used. Sheets of various sizes are used for covering tables, protecting instruments, etc.

Gauze, sheets, towels, cotton, bandages, gowns, etc., done up into packages, are sterilized by steam, and can be kept for a considerable length of time in large, dry, clean jars or other convenient receptacles.

Sea sponges are useful in taking up blood, pus, and fluids. They are far better than gauze, being elastic and yielding and adaptable to the inequalities of irregular surfaces. The absorbing power of the sponge is also greater. They are prepared as follows:

The sponges are beaten with a wooden mallet to crush the calcareous material which they generally contain; they are then soaked for twelve hours in a solution of hydrochloric acid (1:64) to dissolve the lime. They are then washed several times in warm water—until the water remains clear. Next they are immersed in a saturated solution of permanganate of potash for fifteen minutes, squeezed, and placed in a warm saturated solution of oxalic acid, in which they remain until every trace of the color of the permanganate of potash disappears. A thorough rinsing in sterile water follows, the hands being protected with sterile rubber gloves. The sponges are next placed in a solution of bichlorid of mercury (1:1000) for twenty-four hours. They are removed from this, squeezed, and kept in a 5 per cent. solution of carbolic acid. Immediately before operation they are removed from the solution with sterile instruments or hands covered with sterile gloves, and rinsed several times with warm sterile water or salt solution.

Rubber Articles.—Articles made of hard rubber cannot be boiled, and for this reason should be little used. Pessaries and the syringes made of rubber should be thoroughly scrubbed with soap and water and kept in a solution of mercuric chlorid (1:1000). Rubber protective is sterilized in the same manner. Glass nozzles, drainage-tubes and catheters, soft rubber catheters, gloves, and rubber drainage-tubes, are thoroughly washed and then boiled for fifteen to twenty minutes in a carbonate of soda solution. Care should be taken in boiling rubber gloves and other light articles to put them free from air in a coarse linen bag, in a covered vessel. If they float, parts of them escape sterilization. Aspirators



FIG. 7.—DRAINAGE-PAD.

should be made of metal and glass with asbestos-packed joints to enable them to withstand boiling.

Rubber drainage-pads are valuable in gynecologic operations. There are two forms in use, the large celiotomy and the perineal pad.

The former consists of a circular sheet of rubber 62 cm. in diameter with a rim 10 cm. in diameter which is inflated when in use. An apron 62 cm. long conveys the fluid from the receptacle formed by the main portion of the pad. In celiotomy the patient rests with her buttocks about the middle of the cushion.



FIG. 8.—INFLATED PERINEAL PAD IN POSITION FOR USE.

The perineal pad is smaller, of rectangular shape, and is used in operations about the perineum, in catheterization, and in giving enemata and douches.

These pads are scrubbed with soap and water and afterward soaked in a bichlorid of mercury solution.

A rubber cap is now manufactured for the purpose of protecting the metal valve of the pad. The cap is shaped like the finger of a rubber glove, and covers and protects the valve so perfectly that it is not injured by an immersion in a solution, and it is also possible to boil the whole pad without injury.

Vessels for solutions, instruments, dressings, etc., are made of various materials. A consistent technic requires that they should be made of some substance which will not be destroyed by heat sterilization. To this end metal dishes ought to be used. Agateware is the cheapest and best which has yet been devised; these

vessels are not injured by steam sterilization, and are not materially acted upon by mercuric chlorid and other chemicals. Glassware presents an attractive appearance, but its costliness, associated with the fact that it *cannot* be subjected to steam sterilization, makes it far inferior to the metalware. For vessels or receptacles in which to keep packages of dressings and antiseptic solutions glass is best.

Metalware is sterilized in the large steam sterilizer or by boiling, while glassware is best treated by thorough washing and then soaking in a strong mercuric chlorid solution (1:1000) for some hours.

PREPARATION OF THE OPERATOR, ASSISTANTS, AND NURSES.

It is the duty of the operator, of the assistants, and of nurses who help in an operation to strive to avoid all contact with the bacteria of wound infection. This is effected by habits of personal cleanliness, and by keeping constantly in view the possibility of conveying infection not only by the hands and arms, but by the saliva, hair, and clothing; hence arises the necessity of the continuous application of bacteriologic principles to the events of the daily life. He who thinks that he can sterilize his hands by scrubbing with soap and water and soaking them in chemicals after contact with virulent, resistant bacteria, is sooner or later destined to cause the wound infection and, perhaps, the death of his patient. The operator who talks above the wound also takes a risk of infecting his patient. The operator or assistant who examines cases of puerperal infection, ulcerating carcinomata, or infected fibroids, or who brings his hands in contact with suppurating wounds, and one who wears the same clothing in infected and clean cases, is a constant menace to the safety of his patients. The use of rubber gloves to protect the hands, while of the greatest value, has in certain ways served to break down the technic of aseptic surgery. The hands should be washed as carefully, and sterilized as faithfully, as if the gloves were not worn, for holes are frequently made by needle punctures during operation, and sometimes a glove must be taken off to aid the tactile sense during the operation; then the hands which have not been conscientiously prepared are liable to infect the patient. The operator may also imagine that because of this protection he can safely step from an infected case to a clean operation, while here a little hole in a glove may constitute a serious lapse in the technic. The use of thin gloves or finger tips should form a part of the technic of the bimanual examination of every case suspected of being infected, in dressing those wounds where the hands come into contact with the suppurating surfaces, in giving enemata by an assistant, and in the examination of pathologic tissues.

Suspected septic cases should be always put last on the list of operations, and immediately upon concluding an operation on a septic case the hands of those engaged should be carefully sterilized.

In disinfecting the skin the only perfect means of sterilization cannot be applied; furthermore, a smooth skin surface is more easily cleaned than a rough one, while cuts and cracks and sores, as well as the crevices around and under the finger-nails, and the interdigital space, are apt to be imperfectly cleansed. For this reason special care should be given to these conditions.

No one should come to the operating table with a suppurating wound. The hair and beard ought to be kept short and clean. A sore throat, a tonsillitis, a suppurating otitis media, a purulent rhinitis, or any other infectious or febrile disease affecting operator, assistants, nurses, or visitors, may give rise to a virulent wound infection in the patient, and for this reason all such persons must be strictly debarred from the operating room, as well as the convalescent chamber.

Clothing.—Preparatory to operation the outer clothing should be removed, and

suits of sterile duck or linen put on. These consist of a pair of trousers and a jacket for men, and a skirt and a bodice for women. The trousers and skirts are fastened around the waist by a drawstring, and the jacket and bodice are buttoned. Canvas shoes with a heavy soft rubber sole, the whole of which can be steamed, are suitable for the operating room.

The arms should be bared well above the elbow in cleansing the hands and arms; for this reason the jacket should have short sleeves.



FIG. 9.—SURGEON'S OPERATING GOWN.

Those about to be engaged in the operation on stepping up to the table should put on ample sterile gowns, buttoned up the back, with sleeves fastening at the wrists and covering the arms. The operator and the assistants will sometimes do well to wear a waterproof apron under the gown to protect the underclothing from wet. Every one engaged in assisting at the operation should wear *whole* well-fitting rubber gloves; a sterilized linen cap which completely covers the hair is important; a gauze pad covering the mouth and tied over the ears and back of the neck serves to cover the mouth and eliminates any risk from breathing or speaking.

Brushes.—The brushes for scrubbing the hands and arms and those used in preparing the patient should be sterilized before each scrubbing. As this process is extremely hard upon brushes, their cost adds, unless the inexpensive kind is purchased, quite considerably to the expense of the operating room. The brushes best adapted for this purpose have strong wooden backs and are made of the Mexican Tampico grass or other rigid vegetable fiber. The fiber should not be firm or stiff

enough to injure the skin, nor, on the other hand, should it be soft and flabby like a rag. As soon as the brush begins to break and soften it should be discarded. The cost of the fiber brushes is quite small. The brushes after being once used are washed and then laid in a wire basket and sterilized between operations. Several dozens should be ready at the beginning of each day's work in a large clinic.

Disinfection of Hands and Forearms.—With the hands of the surgeon, his assistants, his nurses, and of all coming in intimate contact with the wound, sutures, and instruments, disinfection is of the utmost importance. Many methods

have been devised, none of which will stand the rigid tests of a bacteriologic examination, and, for this reason, rubber gloves and other coverings for the hands and arms have been largely adopted in America and other countries. As stated before, the hands and arms should be prepared as conscientiously when gloves are worn as when the naked hands are used. It is now universally recognized that while the surface layer of the skin can with difficulty be rendered aseptic, the deeper layers contain bacteria which are not reached by the chemicals used in skin disinfection, and these are therefore liable to be set free in the wound, or to infect the ligatures during the operation. The disinfection of the skin depends upon three principles, namely:

(1) The mechanical cleansing by means of warm water, soap, and brush, of bacteria, dirt, oils, hair, etc.; (2) the destruction or inhibition of the development of the microorganisms by means of chemical germicides; and (3) the hardening or fixing of the outer layers of the skin so that they will not be rubbed off during manipulations.

Scrubbing the Hands.—The nails are first trimmed to about 1 mm. in length; then the hands and forearms are vigorously scrubbed with the fiber brush in hot water for ten minutes. Green soap, or the common brown kitchen soap, or some other good detergent soap is used. The water may be made warmer as the hands grow accustomed to it; it should be changed frequently during the scrubbing if running water is not used. Particular attention should be given in scrubbing to the surfaces between the fingers, to the nails, and to any cracks or crevices in the skin. After scrubbing the hands for two to three minutes to remove most of the dirt around the finger-nails and to soften the epithelium and remaining dirt, the nails should be cleansed by means of a blunt-pointed nail blade. The scrubbing is then continued for the rest of the ten minutes. It is not well to guess at the time of scrubbing, but to depend on a clock or an hour-glass placed in good view in front of the basins. After ten minutes' scrubbing the soapsuds are washed off by running water, and the hands and arms carried through the next process.

After the thorough scrubbing before the first operation it is not necessary at subsequent cleansings to wash the hands so long, as all of the oily substances have been removed. Scrubbing for three to five minutes will suffice in these cases. Attention should be given also to any possible infection of the hands after the first cleansing, and after contact with pus or other probably infectious material they should be scrupulously cleansed should it be imperative to continue to operate.

The chemical disinfection of the hands, although not thoroughly reliable, is nevertheless of value and should not be neglected. Many chemical methods of hand sterilization have been devised. The chief germicides which have been used for this purpose are chlorin, mercuric chlorid, and permanganate of potash with oxalic acid. The method used in the Johns Hopkins Hospital and many other clinics is as follows:

The hands after having been thoroughly scrubbed are immersed in a *hot satu-*

rated solution of permanganate of potash and kept there until they are stained a mahogany-brown color. They are next transferred to a hot saturated solution of oxalic acid until all the stain is removed. The hands and forearms are next soaked in a mercuric chlorid solution (1:1000) for five minutes, and finally rinsed in sterile water or salt solution. This is one of the most efficient methods for hand sterilization known; but it sometimes causes irritation of the skin, especially when the hands are carried through the solutions several times in one day.

An admirable method recommended by Rauschenberg and Stimson depends upon the liberation of nascent chlorin gas; it is as follows:

- (1) The hands and arms are washed as in other methods.
- (2) A scant tablespoonful of chlorinated lime is moistened with enough warm water to make a thick paste, which is then thoroughly applied to the hands and arms and carefully rubbed in about the nails.
- (3) A piece of carbonate of soda about an inch square and a half inch thick is crushed and rubbed into this paste until the latter becomes smooth. A sense of coolness will then be experienced following the sensation of heat caused by the liberation of chlorin gas. From three to five minutes are thus occupied.
- (4) The hands are now to be rinsed in sterile water and washed in an aqua ammonia solution of the strength of $\frac{1}{5}$ of 1 per cent. to remove the odor of chlorin.

Many other methods are in vogue, the majority of which include the use of a mercuric chlorid solution. Alcohol is very useful after the hands have been soaked in the chemicals. The application of this to the skin tends to prevent the rubbing off of the superficial layers of the epithelium and by this means to lessen the dangers of infection.

Rubber Gloves.—When the hands have been conscientiously kept free from known infectious material, and have been disinfected after one of the methods described above, they are not liable to prove a source of infection. Since, however, the conscience is not equally acute in all, and since the surgeon who bears the responsibility cannot always know where the hands of his assistants have been, it is safer to adopt the use of rubber gloves as a routine practice for every one who handles the sutures, ligatures, dressings, instruments, and tissues. These gloves are made of india-rubber and should be well fitting and free from holes. In case a hole is torn in the glove finger during the operation, a finger-cot can be drawn over it until the conclusion. Small holes can be mended by means of cement and rubber tissue. The gloves are sterilized by boiling in a carbonate of soda solution or by steam. In boiling, care should be taken to see that the whole of the glove is submerged, or else that the vessel has a well-fitting top, so that the portion which floats above the water is subjected to the action of live steam. They should be boiled fifteen minutes immediately before operation. Operator, assistants, and nurses should put on freshly sterilized gloves before each operation. The best manner of drawing on the gloves is to distend them with sterile water, when the hand enters readily. The gloves after being used are washed and carefully dried. It is my practice to dry the gloves, to avoid the agglutination of apposed

surfaces, by drawing them over wooden pins which enter the fingers. When they are thoroughly dry they are removed and some sterile talcum powder is sprinkled on the inside. No substance containing oil should come in contact with the rubber; vaselin, too, is destructive if left on long. Most gynecologic operations can be as well done with as without gloves, which fit the hand snugly, but in handling very fine silk sutures, in threading needles, and in very delicate work, the gloves sometimes interfere to a certain extent. Practice removes most objections to their use. In tying catgut sutures the gloves, by protecting the skin, enable the operator to tie more firmly than with the naked hands. Gloves last, with proper care, for a few dozen operations, but their cost is considerable. After every use the gloves ought to be washed, sterilized, carefully dried, and put away in a sterile napkin.



FIG. 10.—SURGICAL GLOVE.

The thin corrugated gloves cost about fifty-five cents a pair. Heavy rubber gloves made without seams cost considerably more. I have discarded the heavy gloves made with seams on account of the trouble with the cementing, which often



FIG. 11.—RUBBER GLOVE WITH SLEEVE FOR EXPLORATION OF THE ABDOMEN.

separated in the sterilization. The heavy seamless gloves are more economical, as they far outlast the thin gloves.

I have had a long rubber glove made, its sleeve reaching almost to the elbow to protect the wound in the introduction of the arm for the purpose of exploring the other viscera of the abdomen.¹

¹ Kelly, H. A.: "Exploration of the Abdomen as an Adjunct to Every Celiotomy," *Medical News*, 1899, vol. lxxv, p. 784.

THE OPERATING ROOM.

The best form of operating room is a simple, spacious, rectangular apartment, well lighted by a skylight and windows, with a northern exposure. The doors should be at least three in number, and these should open, one into the sterilizing room, one into an anesthetizing room, and the third into a hallway along which are situated waiting rooms, dressing rooms, etc. The walls and ceiling of the operating room should be smooth, of hard finish, or coated with a waterproof or enamel paint to resist the action of steam and chemicals. The angles and corners of the

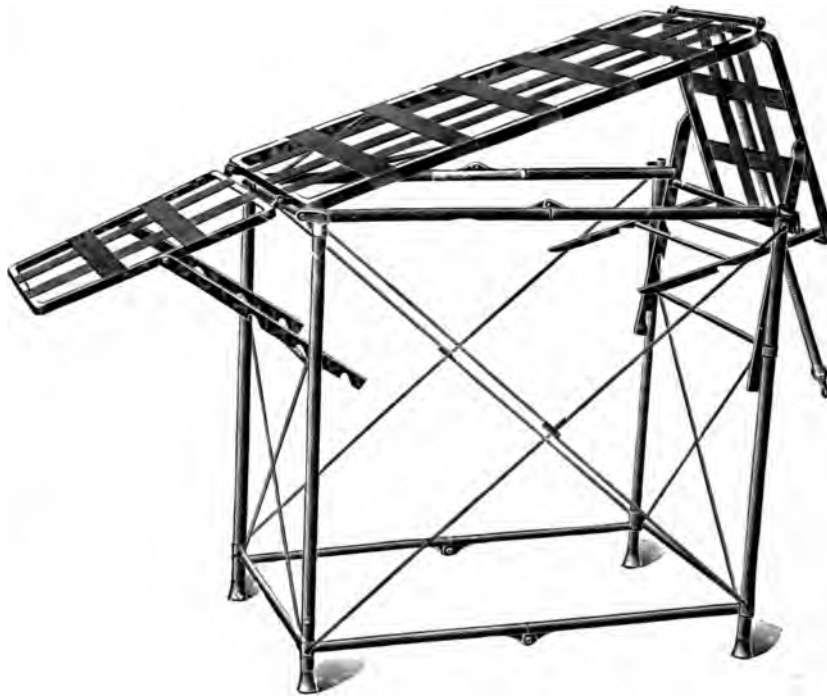


FIG. 12.—PORTABLE OPERATING TABLE OF J. B. SQUIRES, JR.

Weight, 28 pounds, folded for transportation, 19 inches wide, 67 inches long, 34 inches high.

room should be rounded off and there should be as few ledges and cracks as possible in the walls to catch dust. The floor may be made of hard wood, encaustic tiles, cement, or mosaic. Mosaic floors are especially suitable for operating rooms, as they do not readily stain, can be easily cleansed, and are free from crevices. It is convenient to have the floor slope slightly toward an escape-pipe opening. This enables the attendants to cleanse the walls and floor by a stream of water from the tap, and the fluids which fall upon the floor during operations are thus prevented from accumulating under foot.

Ventilation must also be considered, for while the risk of wound infection through the air is not great, there should be no currents of air in the neighborhood

of the operating table, both on account of the possibility of infection as well as to prevent the patient from becoming chilled while in a relaxed condition and perhaps partially uncovered. The heating is best done by means of steam or hot water. Hot air creates draughts and imports dust. It is an advantage in a high building to locate the operating theatre near the top.

The equipments of the operating room ought to be simple. The only furniture which is necessary is the operating table, tables for instruments, dressings and sponges, a few stools, and the receptacles for fluids, soiled dressings, and simi-



FIG. 13.—EDEBOHLS' TABLE WITH STIRRUPS IN PLACE FOR PERINEAL OPERATION.
The ratchet to the right end provides for elevation in Trendelenburg position.

lar articles. Sterilizers, basins for cleansing the hands, and instrument cases, should be in adjoining rooms.

The room should be well lighted with both gas and electricity. There should be an overhead light near the usual position of the operating table, and this should contain several gas jets and incandescent electric lights. A bracket for a portable electric light should be in a convenient position near the operating table.

The **operating table** should be made of iron, painted white, or iron with a glass top, and should be so constructed that the patient can be placed in any position used in surgery. The Boldt table is perhaps the best one in use in this country for operating rooms. For operations away from the hospital some form of

portable table is extremely desirable. The Columbus table, which can be folded into a compact form and packed into a case, or the contrivance designed by Finney and Pancoast, which combines a table and instrument kit, are very satisfactory. The arrangement for heating the table is not generally used in America, but a contrivance made of a number of small cylindrical compartments, which can be filled with warm water, is useful both for keeping the patient warm and protecting her back from the hard top of the table.

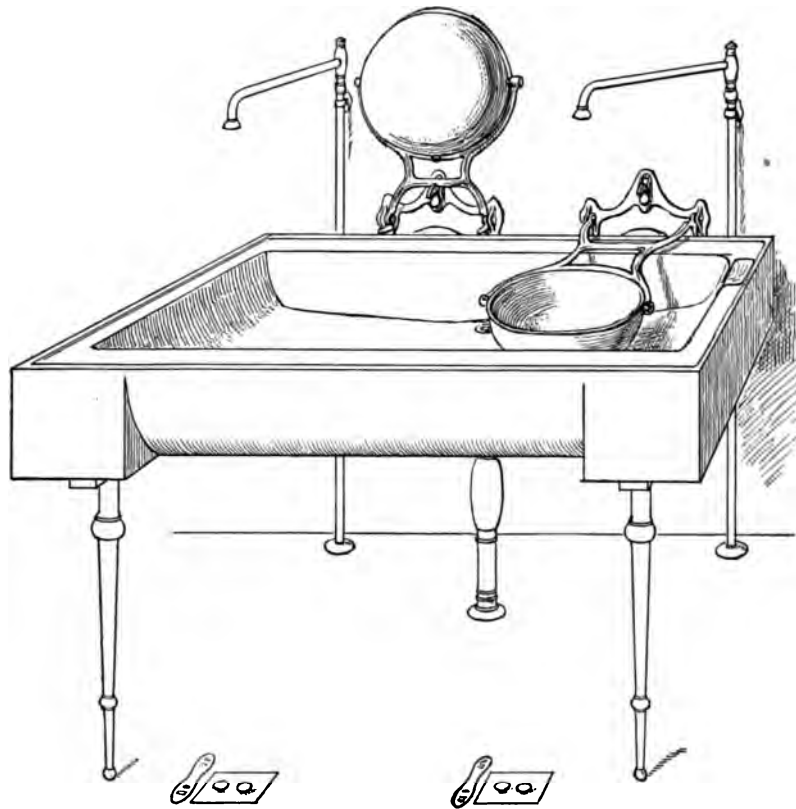


FIG. 14.—ARRANGEMENT FOR WASH-BASINS IN PRIVATE HOSPITALS.

The basins are placed over a large porcelain sink and filled with water by means of Robb's pedals. Each basin swings in its frame, and is emptied into the sink by a light touch on the rim. When out of use the basin and frame are hooked up against the marble slab on the wall, as shown on the left.

Tables and stands for holding dishes which contain the instruments, sponges, dressings, solutions, etc., are made of the same materials as the operating table. If there is a second shelf to the tables, only receptacles for soiled dressings and instruments should be placed on it, as the drippings from the top tend to contaminate anything placed there. There ought to be two complete sets of instruments, dishes, and gloves, so that while one is in use the other may be undergoing sterilization. As in nearly every operating room visiting doctors, students, and nurses are at times present, it is convenient to have one or more stands of iron or wood,

painted white and set on rollers for the visitors, to aid them in following the work. They serve the purpose of hedging off those actually engaged in the operation from any contact with onlookers.

The **sterilizing room** ought to be an adjunct to the operating room, and should contain the steam and hot-water sterilizers, the hand wash-basins, and the vessels containing solutions for hand disinfection, as well as antiseptic and other solutions. It ought to contain a sink for washing dishes, instruments, etc., and a large tank which can be filled with an antiseptic solution for the sterilization of glass, hard-rubber, and other instruments and receptacles which cannot be sterilized by steam or hot water. The room should be large and ought to contain one or two hoods for conveying off gases, steam, and vitiated air. A thermostat, easily regulated at a fixed temperature (105° to 115° F.), is extremely desirable for keeping *salt solution* and other irrigating solutions in readiness. It is arranged so as to contain 6 to 12 flasks of a capacity of 1 to 4 liters. The advantage is that when the salt solution is called for it is always ready and no mistakes can arise as to its temperature.

A carriage arranged for conveying instruments, dishes, flasks, and other articles to and from the sterilizing room serves to save steps and labor.

Other necessary rooms are: a room for storing dressings, clothing, and perhaps instruments; two rooms for the administration of anesthetics; at least two dressing rooms, with a bath attached; a waiting room for patients and another for visitors; a small laboratory for the immediate examination of urine, secretions, or frozen sections; and a room for photography, with an X-ray apparatus.

The sterilizing room should open into the operating room directly on one side and into the room for dressings on the other. It is well to have a dressing room for nurses adjoining one of these rooms. The waiting rooms, doctors' dressing room, laboratory, and all the rooms except those for anesthesia, should open on the passageway. The anesthesia rooms should communicate with each other and open by a passage into the operating room.

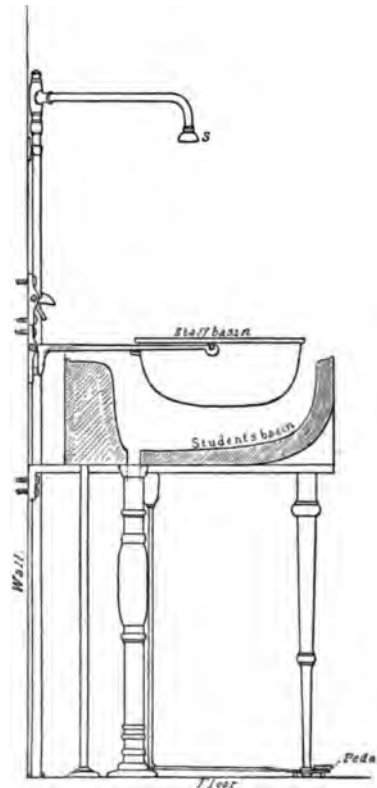


FIG. 15.—THE ARRANGEMENT OF THE HAND BASINS AT JOHN HOPKINS HOSPITAL.

The metal basin used by the operator and house staff is set in a frame which can be elevated as in Fig. 14. The basin is pivoted and easily lifted off from the frame and put in the steam sterilizer before using. Beneath this is a second basin, a porcelain fixture, which is used exclusively by the students before making vaginal examinations, etc. The spray (s) is adopted from the Royal Victoria Hospital operating room.

OPERATIONS IN PRIVATE HOUSES.

While the want of the conveniences of a well-regulated hospital is always felt in operating in private houses, and the technic cannot be carried out to the same degree of perfection, yet with careful attention to the principles of asepsis and antisepsis, no case of infection ought to arise as a result of the operation itself. It is well known that in private practice, especially in the country, remarkably good results are often achieved, even with gross violations of the principles of



FIG. 16.—FRAME CARRYING DETACHABLE METAL BASINS.

Adapted to the porcelain sinks in common use in operating rooms. After the operation the frame may be lifted off and set aside.

aseptic surgery. This is due to the fact that the bacteria of wound infection are not nearly so frequent in such localities as in hospitals. The surgeon who wishes to be assured of uniformly good results ought always, however, to strive to carry out his technic with almost the same degree of perfection as in his hospital service. To this end he must have all dressings, sponges, ligatures, sutures, and towels sterilized beforehand, so as to leave only the sterilization of instruments, catheters, and such articles as can be readily boiled, to be done on reaching the house of the patient.

Every gynecologist will find it necessary, at times, to answer an emergency call to operate away from his hospital. He should, for this reason, always be ready to operate without delay when the call comes; for certain emergency cases, such, for example, as a bad extrauterine pregnancy, cannot be moved away from their homes, while other patients have insuperable objections to entering a hospital.

In order to be always ready for such calls, the gynecologist, if he is busy, will do best to have at least two kits containing all necessary dressings, sponges, ligatures, sutures, bandages, etc., and as one set is used in an operation these articles should be replaced by other sterilized ones.

The first need in such extra-mural operations is the services of good assistants. When the patient can afford it, at least one trained assistant and a nurse should be taken to the case. The assistant should be perfectly familiar with the surgeon's methods, and capable of utilizing the usual household articles for the purpose of surgery. The nurse can assist, if necessary, at the operation and remain with the patient until she is convalescing. At times it becomes necessary to operate without either a trained assistant or a nurse, when the ingenuity and skill of the operator must triumph over all the difficulties. In these cases the surgeon must personally superintend the preparation of the room in which the operation is to be performed, the preparation of the patient, the instruments, the disinfection of the hands of the doctors who assist, and the administration of the anesthetic.

The dressings, sponges, trays, aprons, gowns, and sheets ought to be done up into suitable packages and plainly marked before being sterilized. The glass tubes containing sutures, ligatures, etc., should likewise be marked. A list of instruments needed in abdominal cases, and another for plastic cases, should be put in the hands of the person who prepares the kits, and a list made out for the particular bag in use should be packed in with the instruments. It is better to carry all instruments which might possibly be needed in any case, for one cannot always depend upon the diagnosis of the attending physician, and much embarrassment will be experienced by the surgeon who goes prepared for one kind of operation and finds it necessary to do a totally different one.

Instrument Bags.—Telescope bags made of canvas or leather, with a waterproof cover, make good operating kits. A good size for the bag is 24 by 12 inches. The following articles should be in every operating bag:

- Four nail-brushes wrapped in a cloth and sterilized.
- Green soap in a metal or glass jar.
- Tablets of bichlorid of mercury.
- Tablets of sodium chlorid (sterile).
- Two ounces of oxalic acid in a bottle.
- Two ounces of permanganate of potash in a bottle.
- Brandy, 8 ounces; alcohol, 8 ounces.
- Boric acid powder, 4 to 8 ounces.
- Razor in case.

Ether and cone; chloroform and mask.

Hypodermic syringe and tablets of strychnin gr. $\frac{1}{40}$, atropin gr. $\frac{1}{100}$,
morphin gr. $\frac{1}{8}$ and $\frac{1}{4}$, and cocain gr. $\frac{1}{10}$ — $\frac{1}{4}$.

Gauze, 6 to 8 packages.

Towels, half dozen (sterilized).

Seven sea sponges (sterile).

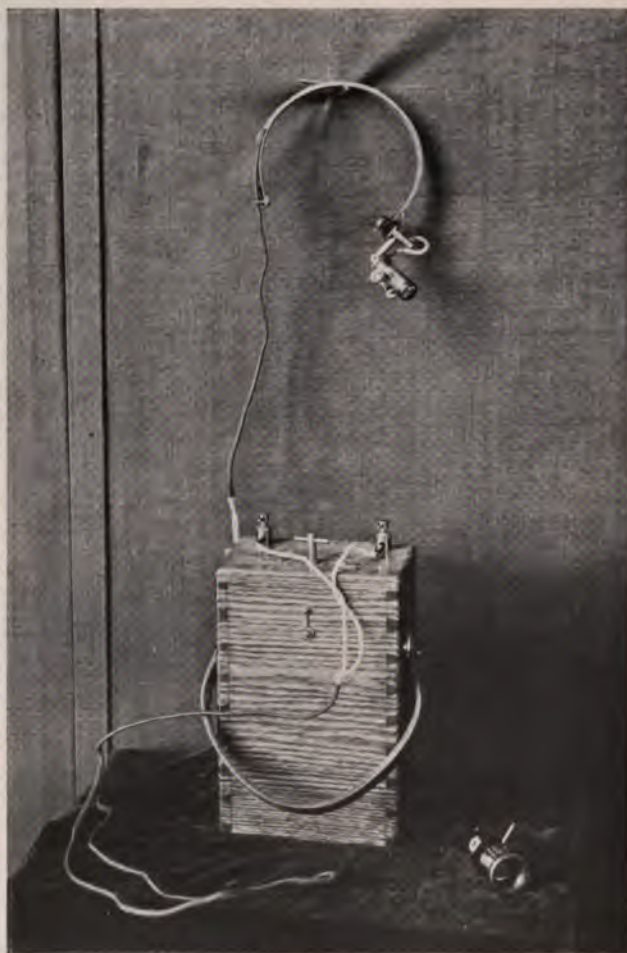


FIG. 17.—PORTABLE ELECTRIC LIGHT WITH STORAGE BATTERY.

Package of sterile absorbent cotton.

Irrigation bag with nozzle (sterile).

Ovariectomy pad.

Abdominal bandage (sterile).

Edebohls' rubber cushion.

Perineal bandage (sterile).

Several gauze and cotton roller bandages.
Storage battery and headlight, or a calcium carbide lamp.
Nest of three porcelain-lined dishes.
Three pairs of rubber gloves.
Two rubber sheets.
Duck suits and canvas shoes for operator and assistants (sterile).
Oilcloth aprons (two).
Three sterile gowns.
Safety-pins.
Two small wide-mouth bottles containing 4 per cent. formalin, 95 per cent. alcohol, or mercuric chlorid solutions (1:1000) for preserving tissue for pathologic purposes.

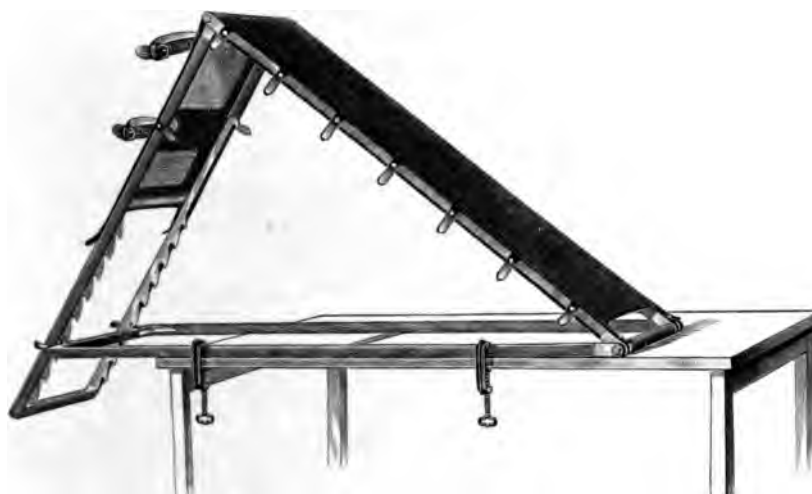


FIG. 18.—MCKELWAY'S PORTABLE FRAME FOR TRENDLENBURG POSITION.

If the operation is to be an abdominal one some device for obtaining the Trendelenburg position is very desirable. A McKelway frame (Fig. 18) or a portable folding table is the best for this purpose.

In doing abdominal surgery in private houses when a good illumination cannot be secured, and on dark days, a portable electric light fed by storage battery (see Fig. 17) is of the utmost value.

Preparation of the Room for Operation.—Where possible, the surgeon, his assistants, or a trained nurse should go to the house of the patient the day before the operation to select the room and to prepare the bed, towels, sheets, pitchers, bowls, water, etc., for the operation. The patient should be prepared at the same time by regulating the diet and bowels, as well as by cleansing the skin and prescribing rest.

The extemporized operating room should, if possible, be located on the same

floor as the bedroom of the patient. It ought to be well lighted, heated, and ventilated. The furniture, carpets, etc., should be removed and nothing left but the operating table, washstands, tables for instruments and dressings, a few plain chairs, a gas or oil stove, and such things as may be needed at the time of operation. In place of taking up the carpet it is well sometimes to lay a drugget on the floor. The walls should be wiped off with a damp cloth and the floor washed. A large piece of new or clean oilcloth under the tables will protect the floor from stains. The table used as an operating table ought to be about 4 feet long, 2 feet wide, and 30 inches high. A common kitchen table can be utilized, if the surgeon has not brought an operating table with him. Two small tables for holding trays and dressings; three or four chairs with wood or cane seats; two clean buckets; one foot-bath tub; three china pitchers and basins; a dozen clean towels; two sheets; two blankets; a wash boiler; and several large bottles for hot water, are needed.

The boiler must be clean, and full of filtered or clear water which has been boiled for one hour and kept hot for the hour of operation. The pitchers and basins should be clean and disinfected with a solution of mercuric chlorid, rinsed repeatedly with boiled water, and several of them finally filled with boiled water which is allowed to grow cold before operation. They ought to be covered with sterile towels.

The patient's bedroom should also be prepared by removing all useless articles of furniture and carpets, and the floor and walls wiped with a damp cloth. It should be cheerful, well ventilated and heated, and exposed to a fair amount of sunlight.

All bed linen, blankets, and clothing for the patient should have been freshly laundered.

The preparation of the operator, assistants, nurses, and patient preparatory to operation does not differ from that in the hospital.

In the foregoing pages an endeavor has been made to give the necessary details of the technic of gynecologic operations. Some of the methods described are imperfect, but they are believed to be the most reliable of those in use. Much is necessarily left out regarding the minute details. If the surgeon has a clear idea in regard to bacteriology and pathology he is not likely to fall into error, and can easily supply the deficiencies in the outline for himself or by referring to special treatises on the subject.

THE INSTRUMENTARIUM.

It is not necessary to describe in detail, nor yet to figure, the numerous instruments commonly used by gynecologists. Excellent cuts are to be had for the asking, in the lists and catalogues furnished by the various instrument-makers of the country. It is a pleasure, as I refer to these fellow-workers who have so splendidly coöperated with the surgeons of all ages, to express in a few words the high sense of appreciation in which the surgical profession holds their admirable labors.

Without the skill and the ingenuity of the maker of surgical instruments the surgical handicraft of today would be unable to perform a large number of those delicate operations which are so constantly employed to bring relief to suffering humanity.

I shall call attention in this section to but a few of the more important instru-



FIG. 19.—ELECTRIC DROP-LIGHT FOR USE IN ABDOMINAL OPERATIONS, CONNECTED WITH HOUSE CIRCUIT.

ments which seem to call for special notice, leaving many others to be described in the various sections where they come into actual use.

The few instruments to which I wish particularly to refer are classified under the following headings:

- Methods of illuminating the field.
- Specula for exposing concealed areas.
- Retractors for holding open the wound.
- Various kinds of forceps and tenacula.
- Needles, needle-holder, irrigator, and packer.

Illumination.—First and foremost, the direct means of illumination of the



FIG. 20.—NELSON TRIVALVE SPECULUM IN POSITION EXPOSING THE CERVIX.

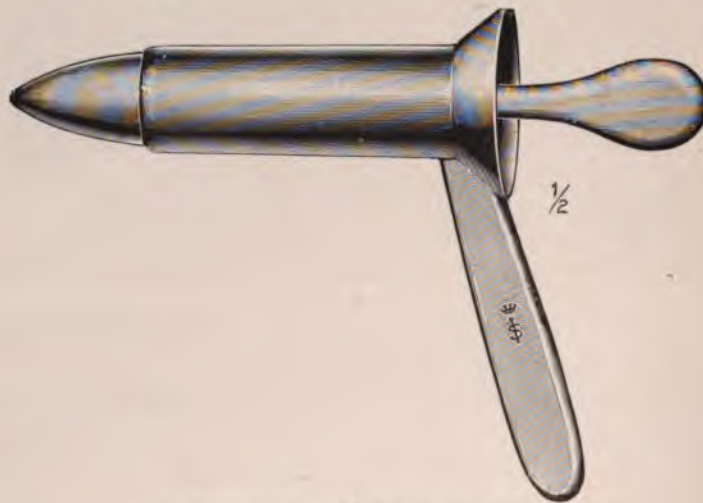


FIG. 21.—KELLY'S TUBULAR VAGINAL SPECULUM.

field in abdominal surgery is often unsatisfactory even in our best appointed opera-

ting rooms. It is best, therefore, in order to secure a good and effective illumination, independent of the capricious sunlight, to have at hand a drop-light fastened on a long handle, to be controlled by a nurse or an assistant; this is conveniently attached to an electric fixture on the wall like that shown in Fig. 19.¹ An electric illumination of the field in the abdomen can also be had by means of a mignon lamp at the end of a retractor. This is especially serviceable in examining the interior of the bladder and catheterizing the ureters.

Specula.—For the examination of the cervix and the vagina, as well as for topical treatments of the cervix and the vagina in the dorsal position, I know of no instrument so entirely satisfactory as the Nelson trivalve speculum (Fig. 20), introduced and exposing the cervix and the upper vagina. In purchasing one of these specula it is well to see that the ends



FIG. 22.—PORTABLE ELECTRIC REFLECTOR.

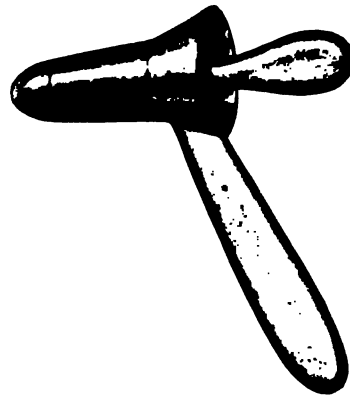


FIG. 23.—SPHINCTEROSCOPE.

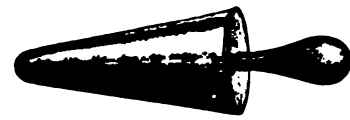


FIG. 24.—KELLY'S RECTAL SPHINCTER DILATOR ($\frac{1}{2}$ ACTUAL SIZE).

are well rounded and spread properly, and that the ratchet between the handles, shown in the lower part of the figure, is a coarse one, so that it requires but a few turns of the loose wheel to set the handles in position. Indeed, the wheel ought to spin up into position with a touch of the finger.

¹ "Electric Illumination of the Field in Abdominal Surgery," Amer. Jour. Obstet., 1894, vol. xxx, p. 348.

Sims' duck-bill speculum is a classic instrument, probably destined to occupy a field of usefulness as long as gynecology lasts. The left lateral (or Sims') position, in which it is serviceable, is not used in these days with the regularity with which it was employed by our predecessors; but nevertheless it still has a limited field of its own, whether for the examination of the vaginal vault and of the cervix in the absence of all vaginal folds, or for the purpose of exposing and operating upon a vesicovaginal fistula, or exposing the vagina by retracting or lifting up the perineum in the knee-breast posture.

Kelly's tubular vaginal speculum (Fig. 21) is made of metal, is slightly conical,

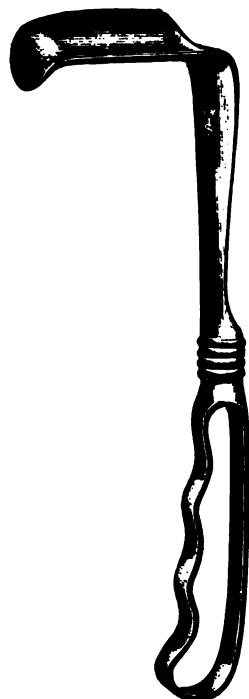


FIG. 25.—HALSTED'S ABDOMINAL RETRACTOR.

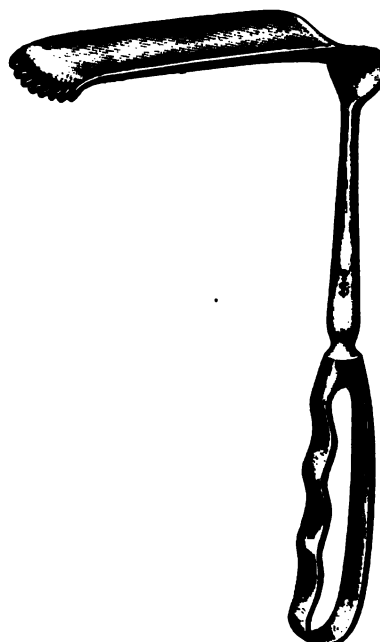


FIG. 26.—KELLY'S LONG-TOOTHED RETRACTOR FOR EXPOSING THE DEEP PARTS OF THE PELVIS.

and is provided with flaring outlet and a long stout handle. This has proved to be of the utmost value for examination and treatments in the knee-breast posture. It is most easy to introduce in this position, as the conical end is closed with an obturator, which is readily conducted through the introitus, when the vagina immediately expands with air. All parts of the vagina are then easily visible under a light reflected from a common head-mirror, and the cervix can be inspected and topical applications can be made just as easily as the parts are seen. This is decidedly the best way to make any limited applications of strong solutions to the cervix or the vagina. The tubular speculum of small caliber with a stout handle is also of service in the dorsal position in examining the vagina and cervix in young women. These thin metal tubular specula controlled by stout handles differ in

their use from the well-known Ferguson and Meyer specula, in that they are of thin metal and have a stout handle, are provided with an obturator, and are



FIG. 27.—SELF-RETAINING RETRACTOR.

used for the most part in the knee-breast posture. I often find it convenient to isolate the cervix with a large size in the dorsal position.

The Proctoscope (Fig. 28).—A set of proctoscopes of various calibers and lengths ought to form a part of every gynecologic armamentarium. The



FIG. 28.—KELLY'S PROCTOSCOPE ($\frac{1}{2}$ ACTUAL SIZE).

gynecologic examination cannot be regarded as completed until the patient is examined with the proctoscope so as to expose the lower part of the rectum distended with air in the knee-breast posture. The disease most commonly found in this way is proctitis (commonly called by medical men "entero-colitis"). Where this

affection is found extending upward in the sigmoid flexure, the longer instruments figured may be used. The short sphincteroscope (Fig. 23) is valuable in investigating the entire sphincter area as well as for the purpose of bringing particular portions of the sphincter area, or individual hemorrhoids, into view within its lumen, where they can be examined and thoroughly cleansed and treated.

Retractors.—Analogous to the specula are the various retractors in general use,—indispensable instruments serving to separate or draw to one side the edges of the abdominal incision for the purpose of exposing the field of operation within. One of the most convenient and generally satisfactory retractors for this purpose is Halsted's (Fig. 25).

Kelly's long-toothed retractor (Fig. 26) has proved a serviceable instrument in my hands for many years past, to lift up and to hold the uterus forward while exposing the deeper portions of the pelvis.

The self-retaining retractor (Fig. 27) does admirable service in spreading the abdominal incision to a maximum, and doing away with one assistant. This instrument is the most valuable, for this reason, to the practitioner who operates in the country.

Forceps.—A great variety of forceps are used for various purposes, among which the following call for special mention:

The tenaculum forceps is an indispensable aid in doing vaginal work, serving to grasp and to fix the cervix during the operation of dilatation and curetage, or while making any topical applications. This instrument is also of use in abdominal hysterectomy in grasping the lower end of the amputated cervix and holding it up while being sutured (Fig. 29).

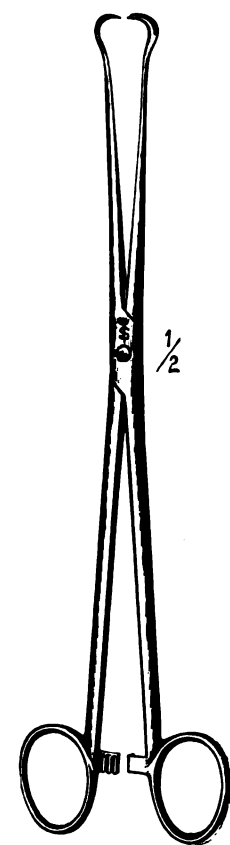


FIG. 29.—TENACULUM FORCEPS FOR GRASPING CERVIX ($\frac{1}{2}$ SIZE).

Analogous to the tenaculum forceps are the *tenacula* of various kinds, right-angled and curved, which are convenient aids in taking hold of the tissues or in tucking tissues away in a plastic operation. The more skilled use of the tenaculum belongs rather to the gynecology of the generation which is now passing away, and this little instrument will hardly ever in the future find such able exponents of its utility as it has had in Sims and Emmet in the past (see Fig. 30).



FIG. 30.—VARIOUS TENACULA.

Numbers 2, 3, and 4 should be more delicate.

The long rat-tooth tissue forceps (Fig. 31) are peculiarly serviceable in grasping tissues deep in the pelvis. They serve both by their length and by means of the curve at the end to keep the hand out of the field of vision while manipulating the tissues.

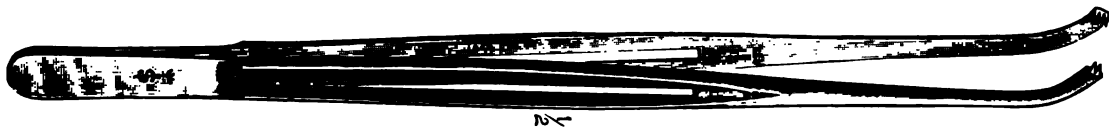


FIG. 31.—LONG CURVED RAT-TOOTH FORCEPS (HALF SIZE).

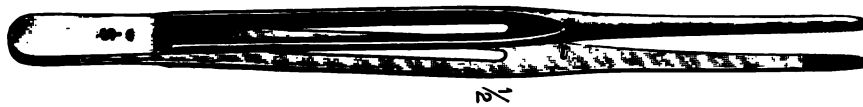


FIG. 32.—ORDINARY DRESSING FORCEPS (HALF SIZE)

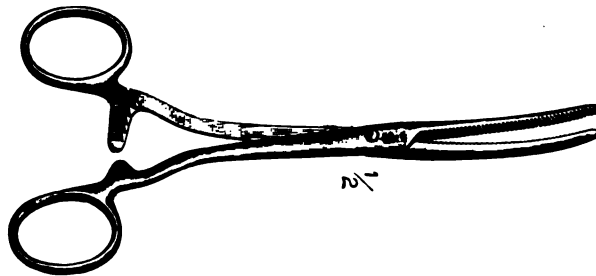


FIG. 33.—ARTERY AND TISSUE FORCEPS, BLUNT POINT CURVED (HALF SIZE).

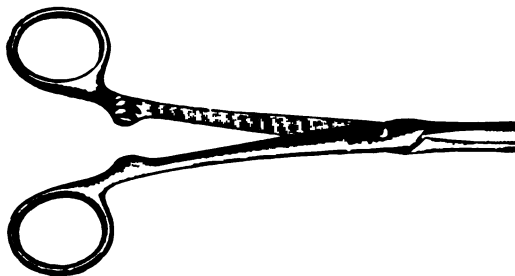


FIG. 34.—ARTERY FORCEPS.

Straight point, for catching small vessels in the incision and in plastic work ($\frac{3}{4}$ size).

C. H. Thomas's dressing forceps (Fig. 32) are a delicate and valuable aid in applying vaginal dressings, especially in the Sims position. I always keep a pair of these forceps at the side of my examining table for constant use in minor gynecologic operations and treatments.

Of the various kinds of artery forceps, I find the curved forceps (Fig. 33) most useful for general use in catching and holding the tissues in the broad ligaments

and in the pelvis. I have them made in two lengths, for more superficial and for deeper work.

The straight artery forceps (Fig. 34) are most serviceable in catching bleeding vessels in the abdominal incision and in plastic work about the vagina.

Kelly's curved bisection forceps¹ are shown in Fig. 35. These stout forceps with powerful interlocking teeth are used to grasp the body when the uterus is split in two from fundus to cervix, in order to expose and control the uterine vessels in the operation of bisection for pelvic inflammatory disease.²

Lastly, I should like to show a pair of forceps (who first had them made I do not know) which I find invaluable in removing dressings (Fig. 38). If a drain is stuck fast, and has become wedged in the tissues, one is enabled by these forceps to take a tight hold and to withdraw the dressing with a strong steady traction. I would not like to miss this instrument from

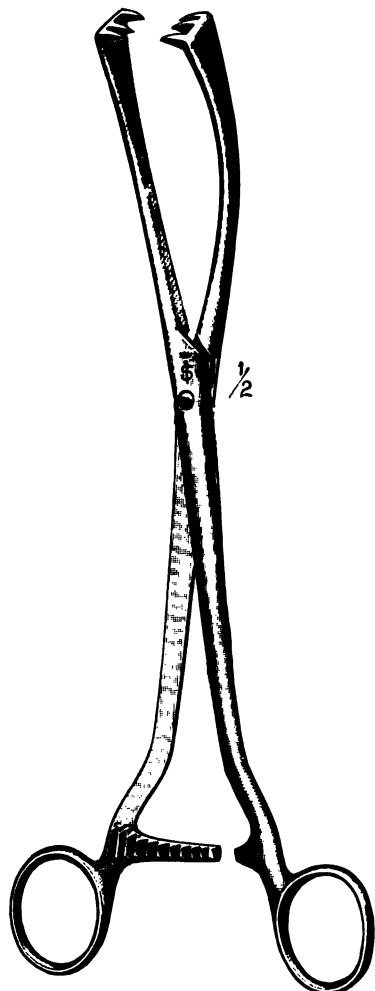


FIG. 35.—KELLY'S CURVED BISECTION FORCEPS (HALF SIZE).



FIG. 36.—NEEDLE AND CARRIER.

my armamentarium in the post-operative management of abdominal and vaginal cases.

Needles and Needle-holders.—I like to use curved needles in all my gynecologic

¹ Kelly, H. A.: "The Removal of Pelvic Inflammatory Masses by the Abdomen after Bisection of the Uterus," *Amer. Jour. of Obstet.*, 1900, vol. xlii, No. 6, p. 818.

² Faure, J. L.: "L'hystérectomie Abdominale Totale par Section Médiane," *Revue de Chirurgie*, 1898, xviii, p. 1136.

work and to thread each needle with a loop of fine silk, tied under the eye of the needle, so as to form a carrier for the introduction of ligatures and sutures. The smaller sized needles are often made conveniently with a split eye (Fig. 37). A round needle, broad and flat under the eye, devised by Ferguson, is most useful and satisfactory.

The best *needle-holder* is one which releases its needle (Fig. 41) on compressing the handle. I also use a long needle-holder corresponding to the long tissue forceps described above for deep abdominal work.

The simple *packer* (Fig. 42) is a useful little instrument in all kinds of gynecologic work, in introducing pledgets of cotton or strips of gauze into the vagina or into the abdomen. By the aid of the packer the gauze can be packed tightly or loosely as the case demands.

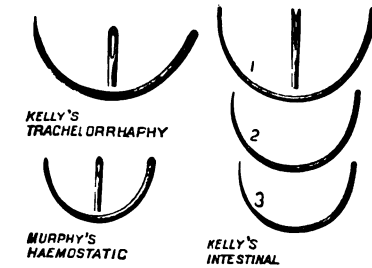


FIG. 37.—VARIOUS CURVED NEEDLES. OVAL EYE ON LEFT; SPLIT EYE ON RIGHT.

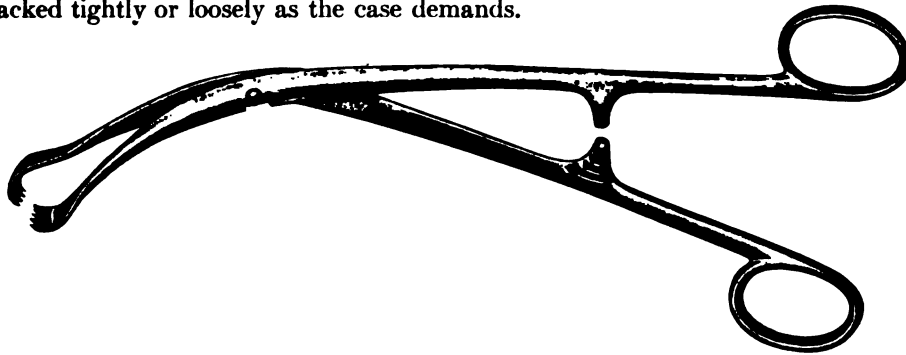


FIG. 38.—STOUT FORCEPS FOR REMOVING DRESSINGS ($\frac{1}{2}$ SIZE).

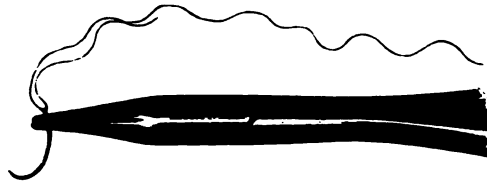


FIG. 39.—NEEDLE-HOLDER WITH SLENDER POINT FOR HOLDING DELICATE NEEDLES WITHOUT BREAKING.

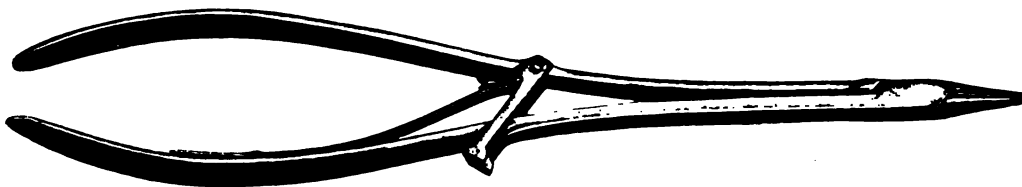


FIG. 40.—LONG NEEDLE-HOLDER (ABOUT $\frac{1}{2}$ ACTUAL LENGTH).

The two-way *irrigator* (Fig. 43) is useful in washing out the uterine cavity through the cervix in pyometra or after curetage.

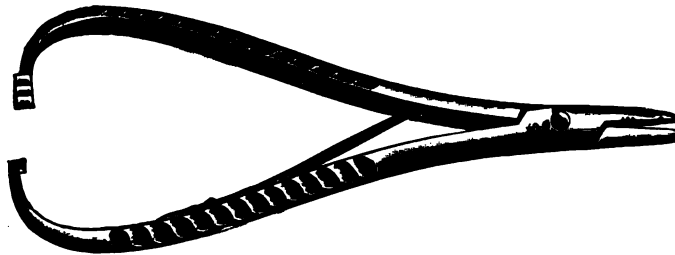


FIG. 41.—SELF-RELEASING NEEDLE-HOLDER (HALF SIZE).



FIG. 42.—KELLY'S GAUZE PACKER

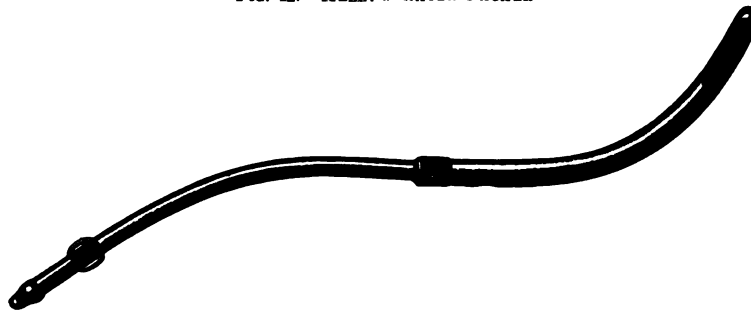


FIG. 43.—TWO-WAY IRRIGATING POINT.

The fluid returns by the oval eye near the point and escapes just in front of the milled ring near the center.

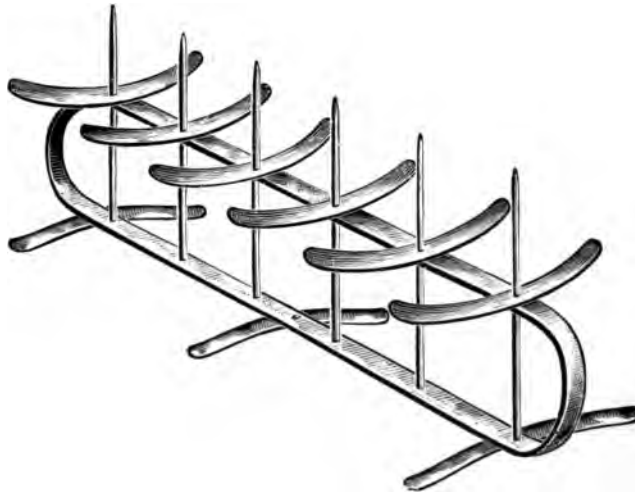


FIG. 44.—RACK FOR GAUZE AND SPONGES DISCARDED DURING AN OPERATION..

The gauze is hung over the flat horizontal strips and the sponges are spiked on the points. There is room for twelve pieces of gauze and six sponges.

A gauze rack (Fig. 44) is used for spiking the gauze or hanging it up, so as to keep every bit of gauze that is used about the operation in one place to prevent accidents in the count after the operation.¹

¹ Kelly, H. A.: "What Precautions shall we Take to Avoid Leaving Foreign Bodies in the Abdomen after Operations?" New York Med. Jour., 1900, vol. lxxi, p. 405.

CHAPTER II.

BACTERIOLOGY.

By WILLIAM W. FORD, M.D.

The microörganisms concerned in infectious processes in man belong to the group of fission-fungi known as *Bacteria*, the relationship of which to disease was first clearly pointed out by Pasteur, and the cultivation of which on artificial media was made possible by the poured-plate method devised by Koch. The minute forms of animal life known as *Protozoa*, many of which have been shown to be responsible for diseased conditions in man, do not, so far as we know, play any rôle in infections proper, and our attention is devoted mainly to the true bacteria. These are unicellular organisms consisting of fairly homogeneous protoplasm without a nucleus, containing in certain species a few granules differentiated by staining methods from the rest of the cell. This mass of protoplasm is inclosed in a delicate sheath or membrane. Bacteria differ greatly in size and in shape, and upon their *morphology*, the majority of systematic classifications rest to-day, their biologic or physiologic characters shown in artificial cultivation in the laboratory serving as a valuable means of identification, but of secondary importance.

The most significant groups of bacteria which may be established upon a morphologic basis are the *micrococci*, the *bacilli*, and the *spirilla*. The micrococci are spherical organisms attached to each other in small clumps, the shape or arrangement depending upon the particular method of segmentation of which each species is capable. If the planes of division be always in the same direction of space, and parallel, the developing organisms assume a chain-like formation known as a *streptococcus*. When the planes of division are indefinite, occurring in any direction of space without regard to the previous line of segmentation, a mass of irregularly arranged organisms is produced known as a *staphylococcus*. Should the planes of segmentation be in three directions of space, always at right angles, a regular arrangement results, and the organisms are known as *tetrads* or as *sarcinæ*.

The elongated microörganisms are known as *bacilli*, or as *bacteria*. They divide always in the same manner, the planes of cleavage lying at right angles to a line representing the length of the organisms. When the individuals remain in juxtaposition a chain of bacilli is produced, but in general these organisms separate soon after division. Some elongated forms reproduce not only by fission but also by the production of spherical bodies known as *spores*, representing a resistant or resting stage. Under certain conditions these spores may remain alive for months or years, again developing into typical organisms when the proper conditions of heat and moisture are supplied. Ordinary spore-bearing bacteria play but an unim-

portant rôle in human pathology, since but two or three species are endowed with pathogenic properties.

Finally, there is a large group of microorganisms which are curved or spirally twisted and which are known as *vibrios* or *spirilla*. These species are abundant in certain situations in the external world, especially in water, but with the exception of the vibrio which is the cause of Asiatic cholera, play no part in infectious processes in man. Many varieties, especially the bacilli and the vibrios, are endowed with independent motility,—organs of locomotion known as flagella, which can be demonstrated by special staining methods, being attached to their periphery. Others, while not possessing flagella, are surrounded by a thick, mucinous capsule, probably developed as a means of protection. This is only visible by special stains. It should be mentioned here that many microorganisms, originally supposed to divide by simple fission, such as the diphtheria and the tubercle bacillus, have been recently shown to pass through a much more complicated cycle of development, thus being allied to some of the higher forms of plant life. So little is known of these higher phases of the life history of these organisms that at the present time it does not seem advisable to separate them from the simpler bacteria.

Examination.—Bacteria may be studied in several ways, two of which are directly applicable to the investigation of surgical disease. Primarily, we may employ the *bacterioscopic method*, which consists in the simple microscopic examination of any material supposed to contain organisms. Such a method of study is especially valuable during the progress of surgical operations, when it becomes necessary for the surgeon to know at once something of the nature of the infecting agent. For this purpose a drop of pus, a scraping from the peritoneal surface of the intestine, a teased up adhesion, a drop of blood, or, in fact, any secretion suspected to be of bacterial nature, may be spread upon a glass slide or glass cover-slip, dried in the air and stained by any of the numerous solutions devised for the study of germs. The most valuable of these stains are aqueous or alcoholic solutions of the anilin dyes, of which methylene-blue, gentian-violet, and carbol-fuchsin are most used. An excess of the dye is added to the dried film on the slide or cover-slip, which is then washed in water, dried, and examined with a $\frac{1}{2}$ oil immersion lens. Such a procedure gives one immediately a certain general knowledge of the presence of bacteria, and of their characteristics. It is possible to determine whether the pyogenic staphylococci or the streptococci are present, or whether the infection is due to an invasion by bacilli. If we employ in addition to the simple anilin dyes certain special stains which require but a few moments' application, still more accurate results may be obtained. The most commonly employed special methods are those of Gram,¹ of Welch,² and the various modifications of Koch's method of staining the tubercle bacillus.

¹ Gram, C.: "Ueber die isolirte Färbung der Schizomyceten in Schnitt. u. Trockenpräparaten," Fortschritte d. Med., Bd. ii, No. 6, S. 185.

² Welch, W. H.: "A Gas-producing Bacillus (*Bacillus aerogenes capsulatus*, nov. spec.) Capable of Rapid Development in the Blood-vessels after Death." Johns Hopkins Hospital Bulletin, vol. iii, No. 24. July and August, 1892, p. 81.

In *Gram's method* the film is stained by gentian-violet and examined for the presence of organisms. If these be found the film is treated for a few moments with a solution of iodine in potassium iodide, known as Gram's or Lugol's solution. The film is then repeatedly washed in absolute alcohol. In this method it is found that certain microorganisms have assumed a blue-black color, which they retain after washing with alcohol, while others lose their color completely in this solution. We thus speak of organisms which retain Gram's stain or which decolorize by Gram's method. This method is especially valuable for the identification of the pyogenic cocci and the gonococcus of Neisser, the former always retaining the color, the latter as invariably losing it.

Welch's method is applicable to the study of capsules and was devised for the purpose of demonstrating these structures on certain important pathogenic species. It consists in treating the dried film with glacial acetic acid to precipitate the mucinous ingredients of the capsule, washing off this acid by the continuous application of gentian-violet, and then finally washing off the gentian-violet by *salt solution*. The film should always be made on a cover-slip which is mounted in salt solution.

In material taken directly from the animal body capsules can readily be demonstrated by the application of Welch's method, which thus becomes valuable for the study of gas bacillus infections, and for the demonstration of the pneumococcus.

Koch's method of staining the tubercle bacillus consisted of the prolonged use of alkaline methylene-blue. The tubercle bacillus stains only with great difficulty, requiring particularly strong dyes, but when once stained retains its color with equal tenacity, all other organisms, except certain acid-fast bacteria, losing the dye when treated by alcohol or dilute solutions of the mineral acids.

Of the various methods devised for the demonstration of this organism the Ziehl-Neelson carbol-fuchsin stain, Fraenkel's modification of this stain, and Gabbet's stain are the most accurate. The last of these is probably the most popular. In it the film is stained by hot carbol-fuchsin followed by a solution of methylene-blue in 25 per cent. sulphuric acid. The tubercle bacilli take on a brilliant red color, which is not removed by the sulphuric acid, while any other organisms present, except acid-fast bacilli, decolorized by the acid, assume the blue color of the methylene-blue. A valuable differential stain is thus obtained.

The *bacterioscopic method* furnishes much valuable information which can be obtained in no other way. For the demonstration of the *streptococcus*, the *gonococcus*, the *tubercle bacillus*, and a few others, it is practically the only method which gives us absolute results, since these organisms are difficult to cultivate artificially and are readily overgrown by any bacteria with which they may be associated. In no case can their presence be eliminated except by repeated and careful study of films made immediately from the suspected material before other bacteria have had a chance to multiply and obscure the picture. For the study of many forms, however,—and this applies to a large group of organisms which have

similar morphology, such as *Bacillus typhosus* and *Bacillus coli*,—the bacterioscopic method must be supplemented by the study of the organism in pure culture upon a variety of cultural media. The most popular of such artificial media are agar-agar, made from a Japanese seaweed; ordinary cooking gelatin; milk, to which litmus may be added; bouillon or broth, made from an infusion of beef; Dunham's solution, made from salt and peptone; blood serum, human, beef, or dog; and solutions of starches, sugars, and alcohols, added to either agar, gelatin, or broth. All these culture-media give us valuable data in regard to the identification of organisms by means of their *biologic* characters.

Every well-equipped operating room should have a special table supplied with the apparatus necessary for a rapid microscopic examination of substances removed during operation. A microscope fitted with a $\frac{1}{2}$ oil immersion lens, a Bunsen burner, platinum needles, glass slides and cover-slips, and various dyes, especially gentian-violet and methylene-blue, are among the essentials. A supply of culture-media should also be at hand, including not only the ordinary varieties but materials necessary for the cultivation of gonococci. Sterile hydrocele or ascitic fluid may be kept in tightly corked flasks, and when the need arises a few cubic centimeters may be added to a tube of melted agar.

In taking cultures it is important that the material be transferred directly to the culture-tubes. If necessary it may be preserved for a short time in sterile dishes, but every transfer adds to the danger of introducing other organisms, the development of which may completely prevent the growth of the pathogenic bacteria responsible for the infection. When pus is suspected to be *gonorrheal* in origin a number of drops of this pus with a few drops of blood should be added to the culture-tubes, since the organism of Neisser is more successfully cultivated in this way.

Sterilization and Disinfection.—Microorganisms retain their vitality only when proper conditions of moisture and heat are present, and, like all other living things, are especially susceptible to deleterious influences. Many of the pathogenic bacteria grow only at the temperature of the body, at which they may be cultivated indefinitely, while others, although multiplying most luxuriantly at 37° C., are also capable of development at lower temperatures varying from 22° to 30° C. Temperatures below 22° C. are unfavorable for growth, and the majority of bacteria are killed by freezing. Few bacteria develop well at a temperature above that of the body, 40° C. inhibiting the growth of most pathogenic species. Certain varieties of thermophilic bacteria grow luxuriantly at 55° to 60° C., an amount of heat which suffices to kill ordinary microorganisms. The thermal death-point of bacteria differs with the species and with the length of time during which the organisms are exposed. The gonococcus of Neisser is killed at a relatively low temperature, 40° C. being sufficient; but this organism forms practically the only exception to a general rule that a temperature of between 55° and 60° C. acting for a half hour is necessary for destruction. Spores are far more resistant to heat than the ordinary vegetative forms, and a temperature of 100° C.,

applied for at least ten minutes, may be considered the lowest limit for their death-point.

All microorganisms are destroyed by *drying*, but the efficacy of this depends upon the number of germs present. Bacteria spread out in thin layers dry quickly and are rapidly killed, but when a large number are aggregated they dry less rapidly and retain their vitality a corresponding length of time. Light has a very rapid action, the direct rays of the sun killing many bacteria in a few hours. All forms are susceptible to the action of certain chemical substances, among which dilute solutions of the mineral acids are the most efficacious. For surgical purposes these acids are of little value in disinfection, since they exert so corrosive an action, and solutions of *carbolic acid* and of the *bichlorid of mercury* in various strengths are now uniformly used. A solution of carbolic acid of the strength of 3 to 5 per cent. (3 to 5 parts of the acid added to 95 parts of water), and a solution of bichlorid of mercury of the strength of 1:1000, will kill nearly all microorganisms in from three to five minutes. Many other disinfectants have been devised, some of which are of real value for the preservation of surgical materials, such as silk, catgut, or kangaroo tendons, but the majority of disinfectants now on the market are quite devoid of germicidal properties.

The best method for disinfection of the skin, next to such mild agents as absolute alcohol, ether, and chloroform, is the one introduced in this country by Kelly in which a saturated solution of potassium permanganate is followed by a similar solution of oxalic acid. While it is not definitely known how the combination of these substances becomes so strongly disinfectant, it is probably due to the oxalic acid, as has been shown by Sherwood,¹ but it must not be forgotten that potassium permanganate itself is one of the strongest germicides we have. Harrington and Walker,² however, have recently pointed out that while absolute alcohol and alcohol containing more than 70 per cent. by volume are practically devoid of bactericidal power, 60 to 70 per cent. alcohol is a most valuable disinfectant, killing resistant pathogenic bacteria both in a dry and a moist condition within three to five minutes. This is true within broad limits of the bacteria of the skin.

Surgical Infections.—The relationship of bacteria to inflammatory conditions of all descriptions is now so well recognized, and the principles involved in the invasion of tissues by microorganisms have been so well and clearly pointed out by a number of authors, that but little need be said on this phase of the subject. It is important to clearly understand the *source* of the bacteria which take part in infections, and to establish their identity. The action of microorganisms depends upon a number of factors. Certain species, like the *Streptococcus pyogenes*, by their very method of multiplication tend to invade the blood and tissues, while others, like the *staphylococcus*, limit themselves to circumscribed areas. The virulence of bacteria depends upon a number of conditions. While there is little experimental

¹ Sherwood, Mary: "Potassium Permanganate and Oxalic Acid as Germicides Against the Pyogenic Cocci," Johns Hopkins Hospital Reports, 1893, vol. iii, p. 359.

² Harrington, C., and Walker, H.: "The Germicidal Action of Alcohol," Boston Med. and Surg. Journal, 1903, vol. cxlviii, p. 548.

evidence in support of the view, clinically it would appear that many of the species now found in surgical disease have suffered considerable loss in pathogenic properties, possibly by the continued use of powerful antiseptics. Certainly serious infections are far less frequent now than formerly, and some surgical diseases, like "hospital gangrene," have entirely disappeared. The constant efforts of the surgeon to prevent the entrance of organisms into operative wounds would of itself greatly restrict the number of infections. Fulminating infections are nevertheless still met with, and bacteria of a high degree of virulence are especially common in certain abnormal conditions, as on the putrefying surfaces of an ulcerating carcinoma of the cervix. Of great importance is a knowledge of the *resistance* which tissues offer to the development of organisms. The normal healthy juices of the body are able to destroy a considerable number of microorganisms, and this power is shared by the peritoneum. When tissues are injured, their vitality is considerably lessened and the chances of infection become correspondingly greater. In all cases the greatest *respect* should be shown them, unnecessary trauma, produced by traction of instruments, prolonged or violent sponging, or other surgical procedures being avoided, so that the necrosis of the cells may be limited. In this way even if a few bacteria gain entrance to operative wounds, infection is less apt to result, a limited number of bacteria being killed by the normal serous exudate produced when tissues are exposed. Recent investigations in bacteriology are of great importance in this connection, since it has been shown that blood serum as well as certain pathologic secretions of the body contain strong *bactericidal* substances, capable of dissolving all sorts of microorganisms. In addition the white corpuscles of the blood, especially the polymorphonuclear leukocytes, are endowed with the power of ingesting and destroying bacteria and other foreign cells. A production of pus made up of polymorphonuclear leukocytes must not be considered entirely disadvantageous, the damage being done by the bacteria and not by the pus cells, whose purpose is the destruction of these bacteria. Inflammation in this light is a conservative or protective process, the bacteria being confined to certain localities and prevented from gaining entrance to the general circulation. To illustrate, the greatest difference is evident between infectious processes in man and in animals, the local reaction in the one case preventing the general distribution of microorganisms through the body, the general absence of this, in the other, favoring their widespread dissemination. While local inflammations with purulent exudate are common in man, septicemias with the development of the microorganisms in the blood are common in animals. With highly virulent microorganisms, true septicemia may occur in man and the bacteria may be cultivated from the blood. Careful technic is necessary in taking cultures from this source, and special care must be exercised to avoid the skin bacteria. The best method consists in the disinfection of the skin over some of the superficial veins of the arm, a small incision being made, a sterile hypodermic needle plunged into the vein, and a few cubic centimeters of blood withdrawn. The blood may be added to melted agar, which is poured into a Petri plate, or it may be transferred to an ex-

cess of bouillon in sterile flasks. In suspected gonorrheal septicemia hydrocele or ascitic fluid must be added to the medium.

Bacteriology of Exposed Surfaces.—Although many species of bacteria are present in the air and in natural waters, the varieties here found are for the most part chromogenic and quite devoid of virulence. The soil is a favorite site for numbers of microorganisms, especially in its upper layers, and many of the species here encountered are pathogenic for man and belong to the resistant type of spore-bearing bacteria. Such organisms as the tetanus bacillus, the anthrax bacillus, the gas bacillus of Welch and Nuttall (*loc. cit.*), the malignant edema bacillus and several others, are constantly present in the soil of certain localities, and no soil is free from some one or other of these highly virulent germs. When we consider the possibility that the spores of these organisms may under normal conditions be deposited upon the skin, especially that of the hands or face, it is not by any means surprising that the exposed surfaces of the body always exhibit a definite flora of microorganisms. That the skin is not a favorable nidus for many of these organisms is shown by the fact that its persistent flora is limited to but a few species. The most important of these are the *pyogenic staphylococci*, the *Streptococcus pyogenes*, *Bacillus pyocyaneus*, the cause of blue pus, and *Bacillus coli*, the most common microorganism found in the intestinal tract. Such organisms as the gonococcus of Neisser, the pneumococcus of Fraenkel, the typhoid bacillus, and others concerned in infectious diseases of man, are apparently unable to maintain an independent existence upon the external surfaces of the body, although it is hardly conceivable that the hands of a large number of individuals should not at some time or other be contaminated by these pathogenic bacteria. When we consider the actual species found on the skin, considerable variation is seen in the relative frequency with which the different types are found. Thus Welch¹ states that *Staphylococcus pyogenes aureus* and *albus*, while almost constantly found upon the hands of doctors and nurses who come in contact with individuals suffering with bacterial infection, were quite rare in people not exposed in this way; while the *Streptococcus pyogenes* was quite infrequent except in persons who had handled infectious material. According to Mühsam, the most frequently encountered microorganism upon the skin is *Bacillus pyocyaneus*, which was present in 50 per cent. of the cases examined. While not found so frequently by other observers subsequent to Mühsam, this organism is present in many individuals about the folds of the groin and axilla. Again, it has been shown by Winslow² that the *Bacillus coli* enjoys a wide distribution upon the hands, being found in a majority of cases in which cultures are taken. By far the most important microorganism of the skin, without doubt, in view of its constant presence in all individuals, is the organism described by Welch as the *Staphylococcus epidermidis albus*. This is a small coccus always present in the deeper layers of the corium, especially about the hair-follicles,

¹ Welch, W. H.: "Conditions Underlying the Infection of Wounds," Transactions Congress American Physicians and Surgeons, vol. ii, 1891, p. 1.

² Winslow, C. E. A.: "The Occurrence of the Colon Bacillus on the Hands," Jour. of Medical Research, 1903, vol. v, p. 463.

whose ubiquity renders absolute disinfection of the skin well-nigh impossible. The "skin coccus" is regarded by Welch as an attenuated variety of *Staphylococcus pyogenes albus*, and is usually devoid of pathogenicity. It may take part in infectious processes of low virulence.

Bacteria of Mouth and Naso-pharynx.—Of great interest to the surgeon, and even possibly of more importance in view of the virulence of the organisms encountered, is the bacterial flora of the mouth and the naso-pharynx. Here a number of virulent species are constantly found, foremost among which are the *Streptococcus pyogenes*, the *pneumococcus*, and certain varieties of capsulated bacteria. The *pneumococcus* has been known for some time to exist in the normal saliva of certain individuals, and cases of pharyngitis and tonsillitis have long been recognized following *streptococcus* invasion in addition to those cases due to ordinary pyogenic cocci. It has only recently been possible to definitely distinguish the *pneumococcus* from the *streptococcus*¹ by the more careful study of capsule formation and the employment of Hiss's medium, and many of our ideas concerning the bacterial flora of the naso-pharynx must be modified. It is probable that all individuals harbor at some time or other pneumococci of the highest degree of virulence, and capable of setting up many changes in man in addition to pneumonia, including some of the more severe types of tonsillitis. In addition to the pneumococcus, virulent streptococci are frequently found in the mouth, while the Friedländer bacillus and some of the closely related species, all possessed of considerable pathogenic action upon man, are often present in nasal catarrh.

It should be pointed out that chronic inflammations of the nose and throat, chronic inflammations of the tonsils, carious teeth, and other abnormal conditions about the naso-pharyngeal cavity offer those peculiar conditions in the life of bacteria which contribute to the survival of microorganisms of a high degree of virulence and suggest the possibility that bacteria of low pathogenic properties may have their properties augmented by their constant presence in diseased conditions. It becomes of special importance, therefore, that the deposition of any of the secretions of the mouth and the naso-pharynx upon exposed wound surfaces should be carefully avoided by the surgeon.

Bacteria of the Intestinal Tract.—The bacteria present in the intestinal tract are of interest and importance to the gynecologist from several standpoints. Organisms from this source may pass through the walls of the intestine and inaugurate inflammatory changes in some of the intra-abdominal structures, as the vermiform appendix, or they may find their way to cystic accumulations or to necrotic tissue masses and there cause secondary inflammations. In all such cases the local infection may serve as a starting-point for local and general peritonitis. The variety and the extent of the infection will depend upon the virulence of the microorganisms in question, although the resistance of the tissues is always an all-important factor. Primarily, any microorganism present in the mouth and in the naso-pharynx may find its way with food and drink to the stomach,

¹ "Studies on the Pneumococcus." Jour. Exper. Med., 1905, vol. vii, No. 5, pp. 401 to 633.

together with a host of organisms derived from water, milk, and the uncooked portions of food. While the acid present in the gastric contents may destroy a large number of these bacteria, it has been shown by Cushing and Livingood¹ by cultures taken from the stomach during life, and by Ford² by cultures taken at autopsy, that a considerable number of different species may survive in the stomach for some time. The most common pathogenic bacteria here are the pyogenic staphylococci and streptococci, although the *pneumococcus* is likely to be conveyed to the stomach with the saliva. In addition, the capsulated *Bacillus lactis aerogenes* described by Escherich³ is always present in this part of the intestinal tract. Many of the bacteria of the stomach do not pass beyond the pyloric orifice, for the duodenum usually contains but a limited number of microorganisms. In the large intestine the number and variety of organisms again increase, the *staphylococcus* and *streptococcus* being present; but the predominant form is *Bacillus coli communis*, the organism found in the intestine by Escherich in association with *Bacillus lactis aerogenes*. Both of these organisms were originally supposed to be devoid of virulence, but further experience has demonstrated that they may take part in extensive pathologic changes in man and animals. Whether in man these microorganisms are able to usher in infectious processes, or whether the original infection is caused by such pathogenic species as the *staphylococcus* and the *streptococcus*, the intestinal bacteria taking up and augmenting the inflammation, is at present a disputed point. In addition to these organisms, *Bacillus pyocyaneus* is frequently present in the contents of the bowel, especially at certain seasons of the year, and *Bacillus faecalis alkaligenes*, an organism described by Petruschky,⁴ is practically never absent from its lower portion. The latter species claims special interest because of its great resemblance to the *typhoid bacillus*, with which it was frequently confused in the earlier literature. The conditions in the alimentary tract are particularly favorable to the development of spore-bearing, anaërobic bacteria, and Welch in his Shattuck lecture (*loc. cit.*) has recently pointed out that the "gas bacillus" is always present in the contents of the human intestine.

Perineum and External Genitalia.—Under normal conditions there are constantly present upon the female perineum a considerable variety of microorganisms which exist upon all portions of the epidermis, such as, the *streptococcus*, *staphylococcus*, and *Bacillus pyocyaneus*. The *staphylococci* are probably always found in this region, but here, as elsewhere upon the intact epidermis, the "skin coccus" of Welch is especially predominant. The bacillus of blue pus, as has been pointed out by Mühsam, is prone to live in the folds of the groin,

¹ Cushing, H., and Livingood, L. E.: "Experimental and Surgical Notes upon the Bacteria of the Upper Portion of the Alimentary Canal, with Observations on the Establishment there of an Amicrobic State as a Preliminary to Operative Procedures on the Stomach and Small Intestine." Contributions to the Science of Medicine, dedicated to Dr. W. H. Welch, Johns Hopkins Hospital Reports, 1900, vol. ix, p. 543.

² Studies from the Royal Victoria Hospital, 1903, vol. i, No. 5.

³ Escherich, Th.: "Darmbakterien des Säuglings und ihre Beziehungen zur Physiologie der Verdauung," Stuttgart, 1885.

⁴ Petruschky, J.: "Bacillus faecalis alkaligenes (N. Sp.)," Centralblatt f. Bakt., 1896, Bd. xix, S. 187.

where the constant presence of a certain amount of moisture gives it, as well as other bacteria, the nutritive material necessary for development. In addition to these species a constant stream of bacteria is poured out with the intestinal discharges and bathes the perineal surfaces. Any organisms in the evacuations would therefore survive for a certain time upon the perineum, and thus, in addition to the species mentioned, *Bacillus coli communis*, *Bacillus lactis aerogenes*, and *Bacillus aerogenes capsulatus* must be present here under many conditions. *Bacillus pyocyaneus*, too, may sometimes appear in the intestinal discharges and be deposited upon the perineum. The majority of these germs do not penetrate the female genitalia beyond the external labia, the mucous surfaces of which furnish conditions for the development of more characteristic organisms. Chief among these is the *smegma bacillus*. This is an organism found constantly in the smegma which derives its chief interest from its resemblance to the tubercle bacillus. It was first described by Tavel and Alvarez (*loc. cit.*) and has since been studied by a number of observers.¹ Like the tubercle bacillus, it is *acid-fast*, resisting decolorization by acids and alcohols, and it can be differentiated absolutely from this bacillus only by animal inoculation.

Despite the constant presence of bacteria upon the perineum, infections of this region are of the greatest rarity. Just as in other regions, the pyogenic cocci may penetrate the deeper layers of the skin and the subcutaneous tissue and produce small boils or furuncles. They may also invade the vulvovaginal glands and cause true abscess formation. Abscesses of these glands are usually secondary to gonorrhea, and, as has been pointed out by Bumm (*loc. cit.*), are more properly considered *pseudo-abscesses*. Infections of the perineum during surgical operations seldom occur, being less frequent than infections in other parts of the body. This may be due to *local immunity*, since these tissues must be constantly absorbing bacterial products from the intestinal tract, while the peculiarly resistant character of the perineum and its abundant blood-supply may also be instrumental in limiting infection. Specific lesions of the external genitalia are of frequent occurrence, and it has been shown by the investigations of Ducrey² that "soft chancre" is due to a characteristic bacillus found in the purulent secretions from this lesion, the same organism being demonstrated by Unna³ in microscopic sections of the tissues. Ducrey's bacillus has been shown by inoculation to convey the disease, and its cultivation has been accomplished upon blood-agar and hare's blood by Bezançon, Griffon, and Le Sourd⁴ and by Davis.⁵ Finally, the etiologic

¹ Cowie, D. M.: "A Preliminary Report on Acid-resisting Bacilli with Special Reference to their Occurrence in the Lower Animals," *Journal of Experimental Medicine*, 1900-1901, vol. v, p. 205.

² Ducrey: "Experimentelle Untersuchung über das Kontagium des weichen Schankers," *Monatschr. f. prakt. Dermat.*, 1889, Bd. ix, S. 221.

³ Unna, P. G.: "Der Streptobacillus des weichen Schankers," *Monatschr. f. prakt. Dermat.*, Bd. xiv, 1892, S. 485.

⁴ Bezançon, F., Griffon, N., et Le Sourd, L.: "Recherches sur la Culture du Bacille de Ducrey," *Annal de dermat. et syph.*, 1901, Tome ii, p. 1.

⁵ Davis, Lincoln: "Observations on the Distribution and Culture of the Chancroid Bacillus," *Journal of Medical Research*, 1903, vol. iv, p. 401.

agent of syphilis, which for so many years has baffled bacteriologic investigators, has apparently been found by Schaudinn¹ in a small spirally curved or twisted organism known as the *Spirochæta pallida*, which in all probability is protozoan in character.

Bacteria of the Vagina and Endometrium.—Considerable difference in opinion has existed in the past as to the extent to which the bacteria of the perineum and the external genitalia penetrate the vagina, and as to the frequency with which either pathogenic or non-pathogenic bacteria may be found in its mucosa. The most important observations have come from Doederlein, Krönig, Menge, and Williams. It is probable that only under exceptional circumstances do bacteria pass beyond the hymen in the virginal condition, although Doederlein² believes that non-pathogenic bacteria always exist in the normal vagina. He has, in fact, described a special bacillus there, which he considers to be the cause of the acid reaction of the vaginal secretions. Krönig³ and Menge⁴ have shown that Doederlein's bacillus is by no means always present in the vagina, and they consider the regular inhabitants of this organ to be certain anaërobic bacteria which are devoid of pathogenic properties. In 500 cases of *pregnant* women, whom Krönig examined, he found a constant acid reaction, the bacteria being of the same general type as those of the normal vagina, non-pathogenic anaërobic. Finally, Williams⁵ has demonstrated that the "vaginal secretion of pregnant women does not contain the usual pyogenic cocci," *Staphylococcus pyogenes aureus*, *Staphylococcus pyogenes albus*, and *Streptococcus pyogenes* having never been found in ninety-two examinations. (In this connection it should be emphasized that the method of making the examination for vaginal bacteria is of the utmost importance. The greatest care should be taken not to introduce bacteria during the very procedure employed to obtain the vaginal secretions, and negative results of both bacterioscopic and culture methods are of greater value than positive. The latter can be explained by errors of technic, while the former cannot.)

Experimental investigations undertaken to solve the same problem have thrown considerable light upon the rapidity with which pyogenic organisms disappear when introduced into the vagina. Menge and Krönig introduced the *staphylococcus*, the *streptococcus*, and *Bacillus pyocyaneus* into the vaginas of pregnant women and found that even in large numbers they rapidly disappeared. Cultures taken from one to six hours subsequent to the procedure revealed a diminution in the number of bacteria, and at the end of twenty-four hours the

¹ Schaudinn, Fritz, u. Hoffmann, Erich. "Vorläufiger Bericht über das Vorkommen von Spirochæten in Syphilitischen Krankheitsprodukten und bei Papillomen." "Arbeiten aus dem Kaiserlichen Gesundheitsamte Berlin," April 10, 1905, xxii, Zweites Heft 527.

² Doederlein, A.: "Das Scheidensekret und seine Bedeutung für das Puerperalfieber," Leipzig, 1892.

³ Krönig, B.: "Ueber das bacterienfeindliche Verhalten des Scheidensecretes Schwangerer," Deutsche med. Wochenschr., 1894, Bd. xx, 25, Nr. 43, S. 819.

⁴ Menge, K.: "Ueber ein bacterienfeindliches Verhalten der Scheidensecrete Nichtschwangerer," *Ibid.*, 1894, November 15, 22, 29, Nr. 46, S. 867; Nr. 47, S. 891; Nr. 48, 907.

⁵ Williams, J. Whitridge. "The Bacteria of the Vagina and Their Practical Significance, Based upon the Bacteriological Examination of the Vaginal Secretion of Ninety-two Pregnant Women," American Jour. Obst., 1898, October, vol. xxxiii, p. 449.

cultures were sterile. As a general rule the *staphylococci* disappear first, the *pyocyaneus* last. We have no exact knowledge of the mechanism by means of which the vagina rids itself of pathogenic bacteria. Apparently it is not the acidity or the alkalinity of the secretion, since the bacteria disappear with equal rapidity regardless of the reaction of the vaginal mucosa. It may be that the vagina of pregnancy secretes strong bactericidal substances¹ which cause the destruction and the disintegration of any bacteria with which they come in contact. The vagina thus, like other organs of the body, would contain in itself those defences which under normal conditions prevent infection. When the vaginal mucosa has become diseased, as in an infection by the *gonococcus* of Neisser, it quickly loses this capacity of freeing itself from pathogenic germs. In an extensive series of examinations, made by Dr. Flora Pollack, of the vaginal secretions in women who were treated for gonorrhea at the Johns Hopkins Dispensary, pyogenic staphylococci and intestinal bacteria were present in the majority of instances. Cultures from the normal *endometrium* are always sterile.² In the endometrium of women immediately after delivery, just as in the normal state, bacteria are seldom present. Little⁴ has recently shown in a series of fifty cases, of which forty were absolutely normal and ten abnormal, that 83.3 per cent. were sterile. Of the remaining 17 per cent. the organisms were the same as those found regularly upon the vulva, including intestinal bacteria and certain staphylococci. Of the 83.3 per cent. considered *sterile*, 15 per cent. showed gonococcus due to previous specific disease, and the remainder were absolutely free from microorganisms.

Gonorrhea.—Pathologic conditions due to the microorganism discovered by Neisser³ in the exudate of acute urethritis are probably the most frequent of all the diseases seen by the gynecologic surgeon, and in view of the wide distribution of the gonococcus and the variety of lesions it may cause, are perhaps the most important. Great differences exist in the resistance of different individuals to infection by this organism, and the extent of the invasion depends to a considerable degree upon the structures attacked. In young women the external organs, particularly the urethra, are especially prone to infection, while in older women with relaxed outlet the vault of the vagina and the cervix uteri are more likely to be involved. The first sign of gonorrheal infection is a yellowish discharge consisting microscopically of epithelial cells, a few polymorphonuclear leukocytes, and myriads of small diplococci either free, upon the surface, or inside the cells. These diplococci stain readily by methylene-blue, but are most clearly differentiated from the ordinary pyogenic cocci by their complete decolorization by Gram's method. As the extent of the urethral infection

¹ Nuttall, Geo.: "Experimente über die bacterien-feindlichen Einflüsse des thierischen Körpers," Zeitschr. f. Hygiene, 1888, Bd. iv, S. 353.

² Opitz, E.: "Bakteriologische Uterusuntersuchungen," Centralbl. f. Gynäk., 1897, Nr. 52, S. 1505.

³ Neisser, Albert: "Die Mikrokokken der Gonorrhœa," Deutsche med. Wochens., 1882, Bd. viii, S. 279.

⁴ Little, H. M.: "The Bacteriology of the Puerperal Uterus," Amer. Journ. Obstet., 1905, vol. lii, p. 815.

increases the character of the discharge changes, a more purulent secretion being established. The disease may be limited to the urethral mucosa, lasting three or four weeks, and undergoing spontaneous recovery, or the inflammation may extend to the bladder and a cystitis supervene. Complete healing of both urethra and bladder may be brought about by appropriate treatment, or the infection may become chronic and a slight discharge, difficult to differentiate from an ordinary leukorrhea, may persist for years. By repeated bacterioscopic examination of such a discharge the gonococcus should eventually be discovered, although many examinations may be necessary.

The irritation produced by the purulent gonorrheal secretions may cause an intense superficial inflammation of the epidermal surfaces of the external genitalia. This inflammation is not specific but partakes of the nature of an eczema (Clark¹). The perineum, the inner sides of the thighs, the labia, and the clitoris may all be involved, the inflammation occasionally resulting in superficial ulcerated patches leaving eventually small condylomata. Owing to the peculiar stratified character of the vaginal epithelium, this organ is usually resistant to gonorrheal infection, and a true vaginitis seldom occurs except in young children and in senile cases where the epithelium is thin and delicate, in both of whom a pure gonorrheal inflammation may occur.

From the urethra the organisms may penetrate the ducts of Bartholin's glands and the gland itself, with resulting Bartholinitis. In this case a tense, painful, fluctuant tumor appears on the labium which may either rupture on its surface or be absorbed. If the external orifice of the duct be occluded and the gonorrheal pus accumulate, according to Bumm, a *pseudo-abscess* is formed, a true abscess occurring only when a secondary invasion of the gland by pyogenic cocci occurs. The acini of the gland are destroyed only in the latter event.

Next in point of frequency to inflammation of the urethra and its communicating structures, the cervix of the uterus is involved. Here the discharge begins as a slimy, bloody secretion which later becomes milky and purulent. If the epithelium desquamates, erosions of the cervix occur, and Klein claims that practically all true cervical erosions are gonorrheal in origin. The mucous membrane of the cervix becomes reddened and swollen, projecting as a sensitive rosette-like growth from the os externum. Clark states that this variety of gonorrhea is particularly prone to become chronic, and during its progress the so-called latent gonorrhea develops, producing no subjective symptoms, and yet able to transmit a virulent infection. Here the Nabothian follicles occur, retention cysts following occlusion of the glandular stomata. From the cervix uteri the disease may pass the internal os and a gonorrheal inflammation of the endometrium result. The discharge first produced is bloody and purulent, but as the disease progresses it becomes slimy in character, in the chronic cases changing to a viscid catarrhal mucus. After a gonorrheal inflammation has been fixed upon the endometrium there is

¹Clark, J. G.: "A Critical Summary of Recent Literature on Gonorrhea in Women," Amer. Journ. of the Medical Sciences, vol. cix, 1900, pp. 73 and 436.

constant danger of extension from fundus uteri to Fallopian tubes, an acute salpingitis developing, which may terminate in *pyosalpinx*, or from which the pelvic peritoneum and the ovary may become infected. During the acute stage the patient suffers sharp pain in both ovarian and tubal regions, this pain being increased by all physical movements of a violent description and being accompanied by a slight fever. Following this stage an accumulation of pus may take place in the tubes (*pyosalpinx*) or the inflammation may subside, the mucous surfaces of the tubes being glued together. If the microorganisms pass through the *walls* of the tubes or the abdominal stomata a local peritonitis may result, in the healing of which dense adhesions may be formed between the tubes and the adjacent peritoneum. The inflammation may become more violent in character, a general gonorrheal peritonitis resulting, as in the case reported by Hunner and Harris.¹ Finally the organisms may invade the ovaries and true ovarian abscesses result. In all cases it should be noted that the gonococcus quickly disappears from the exudate, in some cases its place being taken by secondary invaders, in others the pus remaining free from microorganisms of any description.

In all cases of gonorrhea in women, the disease may become quiescent, the organisms persisting for years, their virulence lighting up and extensive invasion of structures taking place only when some sudden lowering of resistance or production of necrotic tissue occurs, as in the profound changes accompanying child-birth.

Certain points of clinical importance must be emphasized in connection with this disease. Special attention should be directed to the prevalence of gonorrhea in children, where it may occur as a true specific vaginitis or where it may result from accidental transmission of the organism from infected nurses. In children the mucous membrane of the rectum is especially prone to infection, and in all institutions every possible precaution should be taken to prevent the possible spread of the disease by contaminated fomites and instruments.

In newly married women gonorrhea is likely to arise from a previously infected husband, in whom all subjective signs of the disease have disappeared, virulent gonococci still lurking in the urethral mucosa. Gonorrhea becomes in consequence one of the most frequent causes of sterility when the husband has suffered from a double epididymitis, and when the wife has suffered from salpingitis resulting in a complete closure of the lumen of the tubes. In many cases the wife becomes infected at the time of her first pregnancy, a salpingitis subsequently developing, a second conception being prevented by the condition of the tubes, the so-called one-child marriage resulting.

Tuberculosis.—Tuberculous affections of the female genitalia are far more common than was believed before systematic bacteriologic and pathologic examinations of these organs were made, both at autopsy and following surgical operations. The disease may be primary in the genito-urinary system and be the starting-point for general tuberculosis, or it may be secondary to a preëxisting

¹ Hunner, Guy L., and Harris, N. MacL.: "Acute General Gonorrheal Peritonitis," Johns Hopkins Hospital Bulletin, June, 1902, vol. xiii, p. 121.

phthisis. A number of cases of undoubted genital tuberculosis were described during the early part of the last century, although according to Williams¹ the first case of this character was reported in 1744 by Morgagni.² Subsequent cases were described by Louis, Senn, Reynaud, and much of the obscurity in our ideas of this affection was cleared up by the work of Kiwish, Geil and Paulsen. The discovery of the tubercle bacillus by Koch furnished a means of accurate diagnosis in the demonstration of the etiologic agent and combined bacteriologic and pathologic observations have served to demonstrate the wide occurrence of this disease.

Tuberculosis of the vulva is of great rarity, undoubted cases occurring in only a few instances, in the majority of which the patients were suffering from tuberculosis in other regions of the body. The *vagina* may be affected far more frequently than the vulva, although the disease here is likely to be secondary to disease higher up in the genital tract. It occurs in the form of miliary tubercles, by the breaking down of which fairly typical tuberculous ulcers are formed. They possess an irregular outline with sharply cut perpendicular edges. The base of the ulcer is covered by caseous material beneath which lie numerous granulations and about which miliary tubercles may be found. The source of origin of these ulcers is interesting. When situated upon the posterior wall of the vagina and in its upper portion, they are plainly secondary to tuberculosis of the uterus and are the direct result of the deposition of its diseased secretions. In other cases tuberculosis of the vagina is associated with disease of the Fallopian tubes and of the peritoneum, while its association with tuberculous affections of the kidney and bladder has been emphasized by both Virchow³ and Menetrier.⁴ The secretions from the tuberculous ulcers contain tubercle bacilli, which are difficult to demonstrate microscopically, and animal inoculation must usually be employed.

Tuberculosis of the *uterus* is secondary to tuberculosis of other portions of the genital system, especially disease of the tubes, and it is frequently part of a general miliary tuberculosis, although rare cases have been described in which it was the only tuberculous focus found. Williams states that there are three main types of this disease: (1) Miliary tuberculosis with or without the formation of ulcers; (2) chronic diffuse tuberculosis (caseous endometritis); (3) chronic fibroid tuberculosis. It is far more common in the body of the uterus than in the cervix, where, as with the vagina, it takes the form of miliary tubercles by the disintegration of which tuberculous ulcers are formed. Of special importance is tuberculous ulceration of the *cervix uteri*, where the great resemblance to carcinoma must be carefully borne in mind. A ready diagnosis becomes possible if scrapings from the ulcerated areas be carefully examined bacteriologically. While the bacilli may not be found in the original material, the inoculation of a guinea-pig will establish

¹ Williams, J. Whitridge: "Tuberculosis of the Female Generative Organs," Johns Hopkins Hospital Reports, 1893, vol. iii, p. 85.

² Morgagni: "De Ledibus et Causis morborum," Epistola 38, Tome I-II, Liber iii, 34 (Ed. Radius).

³ Virchow: Krankhafte Geschwulste, Bd. ii, p. 679; Berlin, 1865.

⁴ Menetrier: "Ulcerations tuberculeuses du vagin et de la vessie," Bull. de la Soc. anat. de Paris, 1886, p. 454.

the nature of the affection, or a small piece of tissue clipped from the cervix may be examined for miliary tubercles.

The *Fallopian tubes* are more commonly infected by the tubercle bacillus than any other portions of the genito-urinary tract, and usually serve as the starting-point for the disease of this system. It has been shown by Williams (*loc. cit.*) that the tubes are more frequently diseased than was heretofore supposed, and that a lesion of these structures may be the *original focus* for a general tuberculous infection. The appearance of the diseased tubes varies greatly with the severity of the affection. In typical cases they are filled with caseous material, which may also be deposited on their external walls between them and the peritoneal surfaces. The consistency of this caseous material varies, being at times soft and fluid, again dry and hard, partial calcification taking place in rare instances. The tubercle bacillus may be demonstrated in this caseous material either by bacterioscopic examination or by cultural methods, since this secretion is usually free from other bacteria. In many instances the tubes are bound to the peritoneum by dense adhesions, the inflammation of this membrane having been limited to the region of the tubes. In certain cases of genuine tuberculosis, the appearance of the tubes is by no means so typical, and careful microscopic examination of hardened sections may reveal the presence of miliary tubercles in tubes ordinarily deemed free from disease. Finally, tuberculosis of the *ovary* may occur during the progress of tuberculosis in other parts of the genito-urinary system, or subsequent to disease of the peritoneum. It may assume several forms, miliary tubercles, caseous masses, or tuberculous abscesses. Tubercle bacilli may be demonstrated microscopically in the tissues and occasionally in the pus, which rarely is invaded by other species.

Tuberculous Peritonitis.—Tuberculous affections of the peritoneum frequently come to the observation of gynecologists either in their characteristic form or simulating other gynecologic affections. They are best divided (Osler¹) into: (1) Acute miliary, producing a sero-sanguineous exudate; (2) chronic caseous or ulcerating tuberculosis, producing large tuberculous growths tending to caseate and ulcerate; and (3) chronic fibroid tuberculosis, in which little or no exudate is produced. In all forms of peritoneal tuberculosis the tubercle bacillus may be demonstrated in the exudate, but usually with some difficulty.

Puerperal Infections.—The question of auto-infection during the puerperium is now settled, since the clinical observations of Oliver Wendell Holmes and Semmelweis, in the days before the action of bacteria was understood, established the infectious nature of puerperal fever, while in more recent times careful bacteriologic study of normal and infected puerperal women has supplied the necessary scientific facts. Primarily, the vagina and uterus of normal pregnant women may be considered sterile, or at least free from pathogenic bacteria. Any infection which arises during the course of labor is the result of the accidental introduction of microorganisms into the genital organs. An exception to this rule oc-

¹ Osler, Wm.: "Tuberculous Peritonitis," Johns Hopkins Hospital Reports, Baltimore, vol. ii, No. 2, 1890, p. 1.

curs in women who have previously been affected with gonorrhea, since the organism of Neisser may lie dormant in some portions of the female genital tract and acquire greater pathogenicity during childbirth. With this exception the nature of the germs introduced and the resistance exerted on the part of the patient determine the character and the extent of the infection. If the pyogenic cocci, *Staphylococcus pyogenes aureus* and *albus*, be the offending organisms, the inflammation is apt to be limited to the surface of the endometrium, since these bacteria have little power of penetrating deeply beneath the epithelium. The discharge from the uterus is foul and purulent, and the *staphylococci* may easily be demonstrated both microscopically and culturally. Should the organisms be carried by the blood-stream or lymphatics to other regions of the body, metastatic abscesses develop in various regions, and the condition is characterized as *pyemia*. These abscesses are localized in the broad ligaments, the groin, the various joints, the mediastinum, and the internal organs, especially the liver and the kidney. If *Streptococcus pyogenes* is introduced a different condition develops, since the *streptococcus* possesses marked invasive powers and rapidly passes through the endometrium. Here the whole uterine wall may be involved, and from this focus various secondary lesions may be caused. If the organisms grow through the uterine walls the peritoneal cavity may be reached directly and a severe and deadly peritonitis supervene. More frequently, as has been pointed out by Hunner,¹ the streptococcus infection of the uterus is followed by a dense cellulitis in the subperitoneal tissues, a pocket of pus eventually forming which can and should be reached surgically without entering the peritoneal cavity. Finally, and this is true of especially virulent streptococci, the organism may gain access to the blood-stream, a *septicemia* resulting, usually fatal. There are a few genuine cases of *streptococcus* infection where the inflammation is limited to the surface of the endometrium, due to a low virulence of the particular strain in question, or to an extra degree of resistance on the part of the patient. In hospital practice the most frequent cause of puerperal infection is the gonococcus. Little has recently shown in a series of cases examined at the Johns Hopkins Hospital that 20 per cent. of the women who passed through a normal puerperium showed the *gonococcus* in their lochia, while of the abnormal cases 40 per cent. were infected by the same organism. It has also been shown by Taussig² that gonorrheal infection produces the only variety of lochia which has a characteristic appearance. Milder puerperal infections may be caused by certain intestinal bacteria, notably *Bacillus coli communis*, and in rare instances the *typhoid bacillus* may invade the uterine structures during the puerperium, as in a case reported by Dobbin.³

Infection by the diphtheria bacillus may occur at this period, several authentic

¹ Hunner, Guy B.: "The Streptococcus in Gynecology," Amer. Gynecol. and Obstet. Journal, May, 1901, vol. xviii, p. 404.

² Taussig, Fred. J.: "Gonorrheal Puerperal Fever," American Gynecology, 1903, vol. xi, p. 334.

³ Dobbin, Geo. W.: "A Case of Puerperal Infection in which the Bacillus Typhosus was found in the Uterus," Amer. Jour. Obst., 1898, vol. xxxviii, pp. 185, 189.

examples having been reported by Nisot,¹ by Bumm,² and by Williams.³ In all these cases there was a diphtheritic membrane upon the vulva, the microorganism isolated corresponded culturally to the diphtheria bacillus, and relief was afforded by the administration of diphtheria antitoxin. Finally, one of the most important agents in puerperal infections is the "gas bacillus" of Welch and Nuttall. This has now been proved to cause those deaths in the puerperium formerly attributed to entrance of air into the uterine sinuses during labor. In practically all these cases infection by this bacillus has been demonstrated. When the "gas bacillus" remains localized in the uterus either a *physometra* or distention of the uterine cavity by gas may be produced, as in the case reported by Lindenthal,⁴ or *emphysema* of the uterine wall, as has been pointed out by Halban.⁵ In general infection the cases are described under the name of "gas sepsis," or "puerperal gas sepsis." In those cases, which are always fatal, gas bubbles are found in the heart and blood-vessels as well as in the organs and tissues. In a certain proportion of cases the infection probably occurs during life.⁶

Cystitis.—Inflammation of the bladder mucosa occurs in a number of conditions in women, of which gonorrhea, puerperal infection, trauma at operation, and catheterization are the most important. In probably all cases of urethritis the microorganisms of Neisser may invade the bladder, owing to the short urethra, but proof of a definite cystitis in the early stages of the disease is difficult to bring, since it is impossible to state that gonococci found in the urine have not been washed out of the urethra. Frequently one finds in the urine typical epithelial cells which are too numerous to have their origin in the urethral mucosa. Cystitis may occur during or following typhoid fever and in many cases is due to the *typhoid bacillus*.⁷ When the disease follows trauma, instrumentation, or puerperal infection, the characteristics of the urine and the course of the inflammation depend to a great extent upon the nature and the virulence of the organisms involved. A recent analysis by Brown⁸ of sixty cases occurring in the service of Kelly has shown the incidence of the various microorganisms, viz., *Bacillus coli*, 31 cases; *Staphylococcus albus*, 7 cases; *Bacillus tuberculosis*, 6 cases; *Staphylococcus aureus*, 5 cases; *Bacillus proteus vulgaris*, 2 cases; *Bacillus pyocyaneus*, 1 case; *Bacillus typhosus*, 1 case. In this series it may be noted that *Bacillus coli* is far more frequently found than are other microorganisms, and this is explained by the wide

¹ Nisot: "Diphtherie Vagino-uterine puerpérale; Sérothérapie; guérison," Bull. de la Soc. belge. de Gyn. et d'Obst., 1896, No. 1, p. 3.

² Bumm, E.: "Ueber Diphtherie u. Kindbettfieber," Zeitschr. f. Geb. und Gyn., 1895, Bd. xxxiii, S. 126.

³ Williams, J. W.: "Diphtheria of the Vulva," Amer. Jour. Obst., 1898, vol. xxxviii, p. 180.

⁴ Lindenthal, Otto Th.: "Beiträge zur Aetiologie der Tympana Uteri," Monatschr. f. Geb. u. Gynäk., 1898, Bd. vii, S. 269.

⁵ Halban: *Ibid.*, 1900, Bd. xi, S. 88.

⁶ Welch, W. H.: "Morbid Conditions caused by *Bacillus Aerogenes Capsulatus*," Shattuck Lecture, Med. Communicat. Mass. Med. Soc., 1900, vol. xiv, Art. xiii, p. 253.

⁷ Young, Hugh H.: "Chronic Cystitis due to the Typhoid Bacillus," Johns Hopkins Hospital Reports, 1899-90, vol. viii, p. 401.

⁸ Brown, Thomas R.: "The Bacteriology of Cystitis, Pyelitis, and Pyelonephritis," *Ibid.*, 1902, vol. x, p. 11.

distribution of this organism on the perineal surfaces. In some *B. coli* infections a previous specific history suggests that the bladder mucosa has already been invaded by the *gonococcus* of Neisser. The cases of tuberculous cystitis form an independent group, the disease of the bladder being associated with disease in other portions of the genito-urinary system. The existence of *pyocyaneus* infections of the bladder had been previously emphasized by Brown.¹ The investigations of other men agree in the main with the results quoted, except that certain German bacteriologists, notably Flügge,² believe that *Bacillus lactis aerogenes* is of special importance in the etiology of cystitis, its abundant capsular substance giving it a foothold in the bladder mucosa. In infections by *Bacillus coli*, ulceration of the bladder wall is apt to occur, but in many of these cases an antecedent gonorrheal infection has taken place.

In "*Proteus*" cystitis, which is possibly more common than Brown's statistics seem to indicate, the urine is strongly alkaline. Certain varieties of cystitis are peculiarly intractable, but this does not seem to be associated with any particular microorganism. Identification of the bacteria concerned in inflammation of the bladder is not usually difficult. It is important that the anterior urethra be thoroughly cleansed and that the urine be drawn off with a catheter. With the exception of the *gonococcus* and the *tubercle bacillus*, the bacteria are readily cultivated and identified. With these organisms the urine must be centrifugalized and the sediment carefully examined microscopically, using methylene-blue, Gram's stain, and Gabbet's stain. When acid-fast organisms are present, it may be difficult to differentiate between the *tubercle bacillus* and the *smegma bacillus*. In such cases the inoculation of a susceptible animal is necessary. The *smegma bacillus* is without pathogenic action.

DESCRIPTION OF SPECIES.

Staphylococcus Pyogenes Aureus.—Discovered in 1881 by Ogston³ in pus and cultivated in 1884 from the same source by Rosenbach.⁴ Morphologically consists of spherical organisms, usually less than one micromillimeter in diameter, arranged in clusters or bunches. Non-flagellated. Stains well with ordinary anilin dyes and retains the color in Gram's method. It produces a golden yellow pigment, especially in cultures freshly isolated from the animal body, but the power of pigment production and the color of the pigment differ considerably in different cultures. Its capacity of producing pigment is lost when the organisms are cultivated artificially, but this property may be restored by repeated transfer on potato, and is brought out by cultivation on agar made from beef infusion.

¹ *Ibid.*, "Cystitis Caused by the Bacillus Pyocyaneus," Maryland Med. Jour., 1900, vol. xliii, p. 221.

² Flügge, C. G. F. W.: "Die Mikroorganismen," vol. xi, p. 340; Leipzig, 1896.

³ Ogston, Alexander: "Report upon Microorganisms in Surgical Diseases," Brit. Med. Jour., 1881, vol. i, p. 369.

⁴ Rosenbach, F. J.: "Mikroorganismen der Wundinfektionskrankheiten des Menschen," Wiesbaden, 1884.

The organisms grow well on all artificial media and are easily cultivated from pus. On agar it produces a thick, glistening, dull white growth, gradually assuming a yellowish color at the edges, and in active cultures the color rapidly spreads throughout the growth. Agar colonies are opaque, raised, circumscribed, and gradually become deep yellow, if the plates be kept at a temperature of 22° C. In gelatin stab cultures a funnel-shaped liquefaction is produced, the liquefied gelatin turning yellowish. This reaction is characteristic of all true "aureus" cultures. Gelatin colonies develop slowly, gradually liquefying the medium in the immediate vicinity and eventually floating in the center of a small saucer-like depression. In *blood-serum* an abundant dry growth is seen, and rarely the serum is fluidified. *Litmus milk* is acidified and coagulated, the acidity being produced at times rapidly and again slowly, so that coagulation may occur within various intervals. In *broth* a dense uniform turbidity develops, with a few granular masses deposited at the bottom of the tube. Most of the carbohydrates are fermented to the point of acidity, and in sugar solutions the organisms are capable of growth in the closed arm of the fermentation tube. Growth occurs in the complete absence of oxygen. *Indol* is not produced.

Pathogenic Action.—In man *Staphylococcus pyogenes aureus* is the most important but not the sole cause of the production of true pus, in which the organisms are readily identified by the use of Gram's stain. They may lie free in the serum, on the surface of polymorphonuclear leukocytes, or in their interior. It is thus found in the majority of subcutaneous abscesses, in abscesses in internal organs, in osteomyelitis, in tonsillitis, in otitis, in peritonitis, in endocarditis and pericarditis, and in a host of other suppurative lesions, either alone or in association with other microorganisms. When rubbed on the skin it produces subcutaneous abscesses (Garré). When animals are artificially inoculated it produces typical changes. If highly virulent, a fatal septicemia is set up within a few hours and the organisms may later be recovered from the blood. If the animals survive a few days the organisms are localized in various regions, and abscesses are present in the internal organs, the liver and kidney, in the muscles, both voluntary and involuntary (cardiac), and occasionally in the shafts of the long bones. It has considerable resistance to desiccation and will survive in dried pus for one hundred days. When spread out in thin layers it is much less resistant. At a temperature of 58° C. it is killed in ten minutes in a moist condition, but when dried requires 90° to 100° C. It is killed by corrosive sublimate in a dilution of 1 : 1000 in about five minutes, while 3 per cent. carbolic acid destroys the organisms in a few seconds.

Staphylococcus Pyogenes Albus.—This organism was also cultivated by Rosenbach (*loc. cit.*) from pus, and like *Staphylococcus aureus* is one of the most important pyogenic bacteria. It differs from the "aureus" only in its capacity of pigment production, its morphologic appearance, its tinctorial properties, and its cultural reactions being identical. In certain cases it may liquefy gelatin and coagulate milk more slowly. Many cultures of *Staphylococcus albus* represent

strains of *Staphylococcus aureus* which have lost their pigment, and in certain cases pigment will suddenly appear in cultures originally supposed to be devoid of it. The "albus" is usually associated with the "aureus" in suppurative inflammations, but it may inaugurate inflammations of this character.

Staphylococcus Epidermidis Albus.—Found by Welch¹ constantly in the deeper layers of the skin, in which situation it is beyond the reach of disinfectants. It exists normally in the corium, especially about the hair-follicles. It may be the cause of inflammatory changes of a mild character and is probably the cause of many stitch abscesses.

It is regarded by Welch as a variety of *Staphylococcus pyogenes albus*, from which it differs but little in its cultural reactions, except for its feeble growth on artificial media, its slow coagulation of milk, and its very late liquefaction of gelatin.

Streptococcus Pyogenes.—Originally observed by Ogston (*loc. cit.*) in association with the *staphylococci*, and cultivated first by Rosenbach (*loc. cit.*). Distinguished at once from the other pyogenic microorganisms by its appearance in chains, and by its delicate growth in culture-media. Shown later to be identical with the organism obtained in 1883 by Fehleisen² from cases of facial erysipelas, this identity only being proved by the development of spreading inflammations of the skin from localized suppurations. Morphologically it is a small coccus measuring about 0.75 micron in diameter, arranged as a diplococcus, in short chains of six, eight, or ten elements, or in long chains containing as many as a hundred different individuals. No diagnostic value can be attributed to the length of the chains, and the differentiation into *Streptococcus longus* and *Streptococcus brevis* is not justified. It stains well by the ordinary dyes and usually retains Gram's stain. It is readily cultivated on appropriate culture-media, but its colonies are minute in both agar and gelatin and are more often overlooked than are those of most species. When mixed with other bacteria it is rapidly overgrown, and plates made from such mixtures are apt to disclose only the accompanying organisms. Hence *bacterioscopic* examination of suspected material is of far greater value than cultures, even if the plates be examined with a low power lens. In all inflammatory conditions the absence of the *streptococcus* cannot be affirmed unless repeated microscopic examinations of the original material as well as the cultures have failed to reveal micrococci in chains. When pure it is cultivated without difficulty on agar and gelatin, where its colonies are small, transparent, and circumscribed. On the surface of agar it produces a delicate pearl-gray layer, but it develops luxuriantly in the condensation water at the bottom of the tube. It grows in broth either as small flocculi or as a diffuse turbidity. In milk it produces gradually sufficient acidity to precipitate the casein, but this property varies somewhat with different cultures, and at times the milk is apparently unaffected. An alkaline reaction never develops. Neither gelatin nor blood-serum is liquefied,

¹ Welch, W. H.: "Conditions Underlying the Infection of Wounds," Trans. Cong. Amer. Phys. and Surgeons, 1891, vol. ii, p. 1.

² Fehleisen, F.: "Die Aetiol. des Erysipels," Berlin, 1883.

and the organism seldom grows on potato. An acidity is produced in carbohydrate solutions and the *streptococcus* grows well anaërobically in the closed arm of the fermentation tube. It quickly dies out under artificial existence and is destroyed in ten minutes at a temperature of 58° C. Three per cent. carbolic acid kills the organism in the same time.

Pathogenic Action.—The *streptococcus* produces a great variety of lesions, the extent and nature of which depend primarily upon the virulence of the organism, although the resistance of the affected individual plays an important rôle. It may take part in the formation of localized accumulations of pus with the *staphylococci*, but is *par excellence* the cause of the widespread fulminating inflammations of the skin and subcutaneous tissues. It is the cause of general septicemia in man, usually leading to fatal results. It is the most important cause of peritonitis following appendicitis, where it may be the only organism present, or where secondary invasion by various intestinal bacteria may so obscure the picture that the *streptococcus* can be found in the peritoneal exudate only with the greatest difficulty. It causes the most serious cases of puerperal fever and may set up a fatal septicemia in this condition.

Gonococcus.—Discovered by Neisser¹ in the exudate of acute urethritis and first cultivated upon human blood-serum by Bumm.² Morphologically it is a small oval coccus, two individuals being approximated by their flat surfaces in such a manner as to suggest the description "biscuit-shaped diplococcus." It is readily stained by the anilin dyes, methylene-blue being particularly valuable. It is always decolorized by Gram's method. In urethral pus it is frequently found in small colonies between the epithelial cells and also upon their surfaces. It has the special capacity of invading the epithelial cells and the leukocytes, this phenomenon representing, according to Bumm, a vital activity on the part of the micro-organisms and not an ingestion by the cells in a phagocytic character. Its morphology, its position within the leukocytes, and its decoloration by Gram's method, suffice to establish its identity. Originally cultivated upon human blood-serum, quite a variety of media are suitable, to all of which some albuminous constituent of the animal body is necessary. This may be furnished by various pathologic exudates, hydrocele fluid and ascitic fluid being most valuable. Upon hydrocele agar or ascitic fluid agar it grows as a thin, translucent, moist, homogeneous layer whose vitality persists only for a day or two. At best it can be kept alive but for a few generations. It is very susceptible to variations in temperature, growing well at that of the body and dying out if the temperature is raised much above this point. It may be kept alive for some days upon Wertheim's medium, composed of one part of blood-serum to two or three parts of agar, but only when kept from drying. It quickly loses its viability in pus kept outside the animal body, a few hours sufficing for its complete destruction. It is easily killed by disinfectants,

¹ Neisser, Albert: "Ueber eine der Gonorrhoe eigentümliche Mikrooccusform," *Centralbl. f. d. med. Wissensch.*, 1879, Bd. xvii, S. 497.

² Bumm, E.: "Der Mikroorganismus gonorrhöischen Schleimhauterkrankungen," Wiesbaden, 1885.

both nitrate of silver and bichlorid of mercury destroying it rapidly, and it is particularly sensitive to heat, a temperature of 40° to 41° C., acting for a few hours, sufficing for its destruction.

Pathogenic Action.—The gonococcus is the cause of most cases of urethritis in man and woman, and is responsible for the many sequelæ of this disease. In man periurethral abscesses, epididymitis, cystitis, and prostatitis are the most important secondary inflammations, while in woman the infection may spread to vagina, to uterus, and to Fallopian tubes. From the latter structure it may rarely invade the general peritoneal cavity.¹ It is the cause of arthritis developing during the course of urethritis, to which the old name gonorrheal rheumatism was applied. It has been cultivated from the blood-stream by Harris and Johnston,² among others, and it is the etiologic agent in certain cases of endocarditis.³ The eye affections caused by it are of the most serious character both in children (conjunctivitis neonatorum) who become infected from a gonorrheal mother, and in adults, where the organism accidentally finds its way to the conjunctiva. When introduced with foreign bodies, such as bits of agar, into the eyes of guinea-pigs, it sets up suppurative inflammation.

Pseudogonococcus.—This is a term applied by Bumm, by Lustgarten and Mannaberg to certain organisms which exist normally in the healthy urethra, and rarely found in diseased conditions. They bear great resemblance in morphology and staining reactions to the true gonococcus, but can probably be differentiated from this organism. Their identity as specific germs has not been established, and they are now usually regarded as varieties of air or skin cocci which have accidentally found their way into the urethra, where they have adapted themselves to a saprophytic existence, or as attenuated derivatives of the organism of Neisser.

Pneumococcus.—Originally found by Sternberg⁴ in his own saliva, but first described by Pasteur,⁵ who obtained it from the saliva of a child afflicted with rabies. Its relationship to pneumonia was established by the independent work of Fraenkel and Weichselbaum, in 1885. It is now recognized as the cause of practically all the cases of frank lobar pneumonia, of many cases of bronchopneumonia, of pleurisy, of pericarditis and endocarditis, and of meningitis. It may also be a factor in the production of peritonitis and appendicitis, occurring during the course of pneumonia. Morphologically it is a small oval diplococcus often assuming bacillary forms, which from their peculiar elongated appearance are known as lanceolate. It is always surrounded by a definite capsule, which can be stained in exudates, and in cultures freshly isolated from the animal body, by the methods

¹ Hunner and Harris: Johns Hopkins Hospital Bulletin, June, 1892.

² Harris, N. M., and Johnston, W. J.: "Gonorrheal Endocarditis with Cultivation of the Specific Organism from the Blood-stream During Life," Johns Hopkins Hospital Bulletin, 1902, vol. xiii, p. 236.

³ Thayer, W. S., and Lazear, J. W.: "A Second Case of Gonorrheal Septicemia and Ulcerative Endocarditis, with Observations upon the Cardiac Complications of Gonorrhea," Jour. Exp. Medicine, 1899, vol. iv, p. 81.

⁴ Sternberg, Geo. M.: National Board of Health Reports, Washington, 1881, vol. i, pp. 74, 75.

⁵ Pasteur, Louis: Bull. d. l'Acad. de Med., 1881, Jan., Feb., March, pp. 94-422.

of Welch and Buerger. It is somewhat difficult of cultivation, since it is readily overgrown by other microorganisms, and has but little capacity of development on artificial media. When virulent it may best be obtained by the inoculation of susceptible animals, preferably mice or rabbits, in whom it sets up a rapidly fatal septicemia. The organisms may thus be obtained in pure culture from the heart's blood. It grows on the surface of agar as a faint, transparent film, and its colonies in this medium are small and easily overlooked. It produces an acidity and occasionally a coagulation of milk and a faint turbidity in broth. It quickly dies out on artificial media and retains its vitality best in Guarnieri's mixture of agar and gelatin.

Meningococcus.—This organism, known as *Diplococcus intracellularis meningitidis*, was discovered by Weichselbaum¹ in the exudate of spinal meningitis, and is now regarded as the cause of epidemic spotted fever. It is present in many sporadic cases of the same disease. Morphologically it is a small diplococcus appearing within the leukocytes and decolorizing by Gram's method. It thus bears the closest resemblance to the *gonococcus*. It may be differentiated from this microorganism by its cultural characters, since it will grow upon ordinary media or at least upon media which are quite unsuited to the microorganism of Neisser.

Bacillus Coli Communis.—First found by Emmerich² in the stools of cholera patients in Naples, and subsequently identified and studied by Escherich in the intestinal evacuations of milk-fed infants (*loc. cit.*). Now recognized to be universally present in the intestinal tracts of man and all domesticated animals, and to enjoy a wide distribution in nature, especially in soil and water. It is a short, stumpy bacillus measuring usually 0.5 micron in width by 1 to 2 microns in length, appearing as single elements, in pairs or short chains. It is sluggishly motile, and each individual is furnished with 8 to 12 peritrichic flagella. It decolorizes by Gram's method. It is readily cultivated on all media, and its cultural characters are quite distinct. On agar it produces an abundant, thick, moist growth on the surface, spreading rapidly and sloping to the bottom of the tube. Its colonies in this medium are opaque and circumscribed with a well-defined nucleus. Under certain conditions of temperature and moisture it may spread rapidly, producing colonies of bizarre shapes. On gelatin it produces opaque circumscribed colonies which become brownish in old cultures. No liquefaction of the medium occurs. It grows rapidly in broth with a uniform turbidity, reduces nitrates to nitrites, and produces indol abundantly. In milk it causes a rapid acidification and coagulation without any subsequent peptonization of the casein. It ferments almost every carbohydrate known and many of the alcohols, but cannot attack the starches. With dextrose, saccharose, and lactose, the sugars usually employed in studying this organism, a number of acids are produced with the evolution of a gas made up of a mixture of hydrogen and carbon dioxide in the proportion of 2 to 3 parts of the former to 1 of the latter.

¹ Weichselbaum, A.: "Ueber die Aetiologie der akuten Meningitis-cerebrospinalis," *Fortschr. der Med.*, 1887, Bd. v, S. 573, 620.

² Emmerich, R.: "Ueber die in Cholerleichen u. Cholerkranken gefundenen Pilze," *Deutsche med. Wochenschr.*, 1884, Nr. 50, Bd. x, S. 813.

Pathogenic Action.—This organism was at first considered devoid of virulence for man, but more careful investigation has shown that it is concerned in a number of lesions. It may produce true pus, causing subcutaneous abscesses, from which it has been isolated and described as *Bacillus pyogenes fetidus*.¹ It is frequently found in inflammatory conditions within the abdominal cavity and is usually considered to be the cause of the milder grades of appendicitis. The participation of *Streptococcus pyogenes* in the production of these changes cannot be definitely excluded, except by the most painstaking bacterioscopic examination. Its constant presence on the hands has recently been emphasized by Winslow (*loc. cit.*).

Bacillus Alkaligenes.—Described first by Petruschky (*loc. cit.*) from the stools of typhoid patients, but since then recognized as a normal inhabitant of the intestinal tract. Its great importance comes from its resemblance to *Bacillus typhosus*, for which it may readily be mistaken. Morphologically it is a long, slender bacillus measuring 0.5 by 2 to 3 microns in dimensions, growing in pairs and short chains. It is actively motile and is possessed of twelve to fifteen peritrichic flagella. It grows readily upon all culture-media, and does not liquefy. Its most characteristic reactions occur with litmus milk, where an intense alkaline reaction is produced without preliminary acidity, and with the carbohydrates, none of which are acidified. It can thus be readily differentiated from other intestinal bacteria by cultivation in a Smith fermentation tube, where it grows only in the open bulb.

Pathogenic Action.—While quite virulent for small animals it is, so far as is known, without significance for man.

Bacillus Typhosus.—Observed in the lesions of typhoid fever by Eberth,² cultivated upon artificial media by Gaffky.³ It is a long, slender bacillus, actively motile, with peritrichic flagellation. It stains well by all the ordinary dyes, and decolorizes by Gram's method. It is easily cultivated upon artificial media, producing a thin, translucent growth on agar, the colonies in which are thin, slightly spreading, with dentated or leaf-like edges. The submerged colonies are regular and uniform, containing a dark, central nucleus. Gelatin is not liquefied, a uniform turbidity is produced in broth, nitrates are reduced to nitrites, and in rare cases indol is produced (Peckham). On potato the growth was originally stated to be invisible, but this character depends upon the composition of the tuber. It may produce an abundant white growth and rarely a yellowish-brown. In milk the reaction is characteristic. An acidity is produced of moderate extent, averaging about 3 per cent., and never sufficient to precipitate the casein. In the majority of cultures this acidity is permanent, but in a very few it is overcome by a slight alkali production, so that the final reaction is neutral. Many of the carbohydrates are fermented to the point of acidity, but no gas is produced. This

¹ Passet, J.: *Aetiol. eiterigen Phlegmon des Menschen*, Berlin, 1885.

² Eberth, C. J.: "Die Organismen in den Organen bei Typhus Abdominalis," *Virchow's Archiv.*, 1880, Bd. lxxxi, S. 58.

³ Gaffky: "Zur Aetiologie des Abdominaltyphus," *Mittheilungen aus dem Kaiserlichen Gesundheitsamte*, Bd. ii, 1884, S. 372.

acid production and the accompanying growth of the organism in the closed arm of the fermentation tube take place only with certain carbohydrates, the most important of which are *dextrose*, *levulose*, *maltose*, and *mannite*, both *saccharose* and *lactose* being unaffected. Cultures of the typhoid bacillus are *agglutinated* by serum from typhoid patients, and by serum artificially produced by animal inoculation.

Bacillus Pyocyaneus.—First described in blue pus by Gesard¹ and found frequently on the skin of man, about the axilla and groins, and in the intestinal tract. Morphologically, it is a small bacillus measuring 0.5 by 2.0 microns, staining by ordinary dyes. It is very actively motile and each individual bacillus is furnished with terminal or polar flagella. It grows very rapidly on all culture-media and will crowd out any organism with which it happens to be associated. Its cultural characters are well marked, its failure to split up carbohydrates, its rapid liquefaction of gelatin and blood-serum, its coagulation of milk with a subsequent alkali production and peptonization, being the most important. In all media it produces two pigments, a fluorescent substance common to it and other fluorescent bacteria and a peculiar blue-green pigment, *pyocyanin*, which is not produced by any other species.

Pathogenic Action.—It is the cause of that rare and interesting condition of blue pus and may set up extensive inflammations of the skin. From the intestinal tract as a portal of entry it may cause general septicemia, especially in young children. It is rarely found in cystitis, and occasionally is responsible for ascending infections of the genito-urinary system.

Bacillus Lactis Aerogenes.—First described by Escherich (*loc. cit.*), who discovered it in the upper portion of the intestinal tract in milk-fed children. *Morphologically*, it is a short, stumpy bacillus, non-motile, surrounded by a mucinous capsule which may be stained by precipitation with acetic acid and application of gentian-violet (Welch's method). It is readily cultivated on all artificial media and is characterized by the viscid, slimy appearance of its growth. It does not liquefy any media, occasionally produces indol, acidifies and coagulates milk, and splits up all the carbohydrates, as well as a number of the starches. It frequently produces an abundant growth on potato, in the interior of which small blebs or bubbles of gas may be seen. It is without pathogenic action for man except in cystitis and as a secondary invader in inflammation of the peritoneum.

The Proteus Group.—These organisms are the most important cause of putrefaction, and were first obtained from decomposing materials by Hauser.² They are frequently found in association with pathogenic bacteria and are especially apt to invade structures whose vitality is lowered by antecedent inflammation. A number of different species have been described, known as, *Proteus vulgaris*, *Proteus mirabilis*, *Proteus Zenkeri*, and *Proteus Zopfii*. The differentiation between them is difficult, and depends upon the rapidity with

¹ Gesard, C.: "De la pyocyanine et de en dépendent dans les liquides organiques applications," Thèse de Paris, No. 248, 1882.

² Hauser: Ueber Faulnis-bakterien, 1885.

which gelatin and blood-serum are liquefied and carbohydrates are fermented. Both *Proteus vulgaris* and *mirabilis* consist morphologically of short, slender bacilli which are occasionally in a state of active, violent motility and occasionally are quiescent. They grow rapidly upon agar and exhibit characteristic spreading colonies, the edges of which show peculiar leaf-like outgrowths. In gelatin these colonies rapidly liquefy the medium, and "swarming colonies" are produced by currents of liquefied gelatin set in motion by the myriads of lashing flagella. Blood-serum is always liquefied,—an important diagnostic point,—and milk is coagulated and peptonized with an alkaline reaction. Some strains of these species split up many of the carbohydrates, including dextrose, saccharose, and lactose, while other strains have no action upon lactose. *Proteus Zenkeri* and *Zopfi* do not liquefy gelatin or blood-serum and have no fermentative action upon the sugars. The proteus group is largely important as secondary invaders and in the etiology of cystitis.

Bacillus Diphtheriæ.—Described by Klebs¹ and first cultivated by Loeffler.² Morphologically it is a straight or slightly curved rod averaging 1.2 to 2.5 microns in length, in the protoplasm of which are a number of granules. When these are properly stained they give the organism a characteristic appearance. Forms with club-shaped extremities are most frequent, but barred forms are rarely met with. Occasionally true branching has been observed, suggesting a higher cycle of development. It stains with the ordinary dyes, but presents its typical appearance rarely in culture-media, the fresh exudate in cases of diphtheria being most suitable for microscopic examination. It is perhaps best stained by Neisser's method, which consists of methylene-blue followed by Bismarck-brown. In this the granules are stained blue and the protoplasm brown. The diphtheria bacillus grows well on ordinary media, but especially rapidly upon Loeffler's blood-serum. Its reactions with other media are not characteristic, and its identification rests upon its morphologic appearance and its pathogenic action upon animals. It is the cause of all cases of true diphtheria as well as of some of the milder inflammations of the throat, such as tonsillitis and pharyngitis, where no false membrane is formed. It is also the cause of some of the sequelæ of diphtheria, such as pneumonia (Flexner) and endocarditis (Howard), and rarely of extensive inflammations of the subcutaneous surfaces following excoriation of the corium (Loeffler, Wright). It may be associated with the pyogenic cocci in subcutaneous inflammations. It is highly virulent for small animals, particularly for guinea-pigs, where subcutaneous inoculation is followed by local necrosis with necrotic foci in the internal organs, especially the liver. Death occurs in these animals either at the end of four to five days, from acute intoxication, or after the lapse of several weeks from emaciation and paralysis. Its pathogenic action depends upon its secretion of a powerful toxin of a complicated chemical composition, the effects of which are completely neutralized by antitoxic serum.

¹ Klebs, Edwin: Verhandl. d. Congr. f. innere Med., 1883, Bd. ii.

² Loeffler, Fr.: "Untersuchungen über die Bedeutung der Mikroorganismen für die Entstehung der Diphtherie beim Menschen bei der Taube und beim Kalbe," Mittheil. a. d. Kaiserl. Gesundheitsamte, 1884, Bd. ii, S. 421.

Pseudo-diphtheria Bacilli.—These organisms were first described by Loeffler,¹ and were supposed by him to differ from the true diphtheria bacillus only by lack of virulence. It has since been shown by Hoffmann-Wellenhof² that organisms exist with the morphology of the diphtheria bacillus, but which differ from it in cultural reactions as well as in virulence, and Hamilton³ has recently described a large group of these organisms differing considerably in cultural characters and pathogenic action, some of them being differentiated from the true diphtheria bacillus only by their secretion of a different toxin, which is not neutralized by diphtheria antitoxin. They have some importance in gynecology, since they may be present in the mucous surfaces of the vagina and the external genitalia and be mistaken for the genuine *diphtheria bacillus*.

Bacillus Tuberculosis (Koch, 1884).—The *tubercle bacillus* was discovered by Koch⁴ in 1882, and cultivated by him upon beef blood-serum. About the same time it was demonstrated microscopically in tubercles by Baumgarten. It usually appears as long slender rods 1.5 to 4 microns in length, containing in stained specimens clear, unstained dots or granules, giving the organism a beaded appearance. The organism is non-motile, being devoid of flagella, and recent investigations of its morphology indicate that it is capable of branching. The tubercle bacillus is stained with difficulty by ordinary anilin dyes, but when stained retains the color more tenaciously than do ordinary bacteria. The staining is best accomplished by the use of hot concentrated dyes, of which carbol-fuchsin is the most valuable. Following the use of such dyes various decolorizing agents may be employed, either dilute solutions of the mineral acids or alcohol. While the tubercle bacillus retains the color when so treated, all other bacteria, with the exception of the *smegma bacillus*, the *leprosy bacillus*, and other members of the acid-fast group, are completely decolorized. Various methods of applying this principle of staining and decolorization have been suggested for the demonstration and identification of the *tubercle bacillus*, of which possibly the most valuable is the one devised by Gabbet, which consists of the application of hot carbol-fuchsin followed by a solution of methylene-blue in sulphuric acid. Here the tubercle bacillus is stained red, the other microorganisms and the pus and epithelial cells blue.

Cultivation.—The *tubercle bacillus* is cultivated with great difficulty, the best medium being human blood-serum, although beef blood-serum and dog blood-serum are also valuable. It grows also on agar to which 5 to 6 per cent. glycerin has been added. The growth appears after ten to twelve days as minute, irregular, raised excrescences. If the organism be transferred repeatedly to fresh

¹ Loeffler, Fr.: "Die Ergebnisse weiteren Untersuchungen über die Diphtherie-Bacillen," Centralbl. f. Bakt. u. Parasit., 1887, Bd. ii, S. 105.

² Hoffmann-Wellenhof, G. V.: "Untersuchungen über den Klebs-Löffler'schen Bacillus der Diphtherie und seine pathogene Bedeutung," Wien. med. Wochenschr., 1888, Bd. xxxviii, Nr. 3, S. 66.

³ Hamilton, Alice: "The Question of Virulence among the so-called Pseudo-diphtheria Bacilli," Journal of Infectious Diseases, 1904, vol. 1, p. 690.

⁴ Koch, Robert: "Die Aetiologie der Tuberculose," Berl. klin. Wochenschr., 1882, Bd. xix, M. 15, S. 221.

media, it gradually assumes a saprophytic existence and produces a dry, mealy, fairly abundant growth. In *broth* it slowly produces a dull white, wrinkled scum on the surface, of quite a characteristic appearance.

Resistance.—The tubercle bacillus is the most resistant of all bacteria not known to produce spores. It is not killed by exposure to a temperature of 60° C. for forty-five minutes (Forster), but is destroyed by an hour's exposure to this temperature and by ten minutes' exposure to 70° C. It is quickly destroyed by boiling for a few minutes. When dried in sputum, vitality is retained for several months, but the application of 3 per cent. carbolic acid to sputum kills the organisms in twenty hours. When in a medium which allows the free access of the acid to the organism, 3 to 5 per cent. carbolic acid kills it in a few minutes. It resists the action of the acids present in the gastric juice.

Animal Inoculation.—In many cases repeated examination of material suspected to be tuberculous fails to reveal the bacillus, in which event some susceptible animal must be inoculated. For this purpose the guinea-pig is usually selected, and a small bit of tissue, a few drops of pus, and a little sputum are placed under the skin, preferably in the looser subcutaneous tissues of the abdominal wall. If the material contains virulent tubercle bacilli, the adjacent lymphatic glands soon enlarge and may be felt as hard granular nodules beneath the skin. As the disease progresses the animal emaciates, gradually becomes weaker and weaker, dying after the lapse of three or four weeks. It may be killed at the expiration of a fortnight or three weeks. At autopsy caseous deposits are present in the lymphatic glands, and the internal organs, particularly the liver and kidney, are the seat of numerous miliary tubercles.

Smegma Bacillus.—Discovered by Tavel and Alvarez¹ in 1885 in the preputial secretions of man. Of importance from its great resemblance to the *tubercle bacillus*. Morphologically it is a slender, slightly curved organism, usually shorter and a little thicker than the tubercle bacillus. It stains with difficulty, requiring the use of hot concentrated dyes and resisting decolorization by alcohol and the mineral acids. It is stated by some authors (Muir and Ritchie) that it can be decolorized by the combined action of alcohol and sulphuric acid. It is cultivated with great difficulty, but will develop upon blood-serum and glycerin-agar. As far as is known it is without pathogenic action.

Bacillus Ulceris Cancrosi.—The cause of soft chancre was first observed by Ducrey (*loc. cit.*) in purulent discharge from these lesions, and was later demonstrated microscopically by Unna in sections through the tissues. Microscopically it is a minute oval rod, measuring 1.5 microns in length and about 0.5 micron in thickness. When taken from the secretions it is usually mixed with other bacteria, but when found in the tissues it shows a characteristic arrangement in parallel rows between the epithelial cells in chains of considerable length. It rarely lies within the leukocytes. It stains readily with the anilin dyes, but loses its color when the tissues are dehydrated. It has been successfully cultivated upon blood-agar

¹ Tavel and Alvarez: "Archiv. de phys. norm. et path.," 1885, Tome vi, p. 303.

made from human, dog, and rabbit blood, by Besançon, Griffon, and Le Sourd (*loc. cit.*) and by Davis (*loc. cit.*). It is the cause of soft chancre and the probable cause of the secondary buboes. It is present in a pure condition only in the early stages of these buboes, the pus production being usually due to secondary invasion by pyogenic cocci.

Doederlein's Bacillus.—Found by Doederlein (*loc. cit.*) in the vaginal secretions. It is a small slender bacillus which grows with difficulty upon ordinary media. If some of the vaginal secretion be added to glucose bouillon, the organism can be cultivated and transferred to glycerin-agar, where it produces dewdrop-like colonies. It is without pathogenic action.

Bacillus Aerogenes Capsulatus.—Discovered by Welch (*loc. cit.*) in a case of aortic aneurism in which the tissues were studded with gas blebs and from the blood and organs of which the organisms were obtained in pure culture. It is probably the most widely distributed organism known, being constantly present in the intestinal tract of man and the domestic animals, in soil, in water, in milk, and in dust. It is identical with the organism described in 1893 by E. Fraenkel¹ as the cause of emphysematous gangrene or gaseous phlegmon. It has been described under a variety of names, such as *Bacillus enteritides sporogenes* of Klein, and *Bacillus perfringens* of the French writers. It is purely anaërobic, growing only in the complete absence of oxygen. With proper methods it can be cultivated without difficulty, but when mixed with other organisms may require special means for its isolation. Microscopically, it is a rather large bacillus, measuring over 1 micron in width and 1.5 to 2 microns in length. Each individual is surrounded by a mucinous capsule which can readily be stained by Welch's method. This consists of the application of glacial acetic acid followed by gentian-violet. The latter is washed off in salt solution and the film is mounted for examination in salt solution. It stains well with ordinary dyes, which do not reveal the capsule. It retains Gram's stain.

Cultural Reactions.—The gas bacillus grows best at a temperature of 37° C., and but slowly at the temperature of the room. It can be cultivated in the depths of solid media, such as agar and gelatin. Agar colonies are grayish-white or brownish, occasionally showing a dark central nucleus. The contour of the colony is irregular, fine hair-like or feathery projections marking its edge. If various sugars be added to agar, a characteristic appearance is produced, the block of agar being broken up into small bits by the production of large quantities of gas. Similar reactions occur with sugar-gelatin. In milk the casein is precipitated, the litmus completely decolorized, minute gas bubbles appear in the curd, which is soon rapidly digested, presenting a worm-eaten or furrowed appearance. Subsequently the clot may be completely converted into a clear yellowish serum with a small precipitate consisting of a few remnants of undissolved casein. It produces spores readily, especially upon blood-serum.

¹ Fraenkel, E.: "Ueber die Aetiologie der Gasphlegmone (Phlegmone emphysematosa)," Centralblatt f. Bakt., xiii, S. 13.

Methods of Isolation.—Owing to the frequent presence of other bacteria with the gas bacillus, special methods must be adopted for its isolation in pure culture. The mixture may be heated to 80° C. for a few minutes with the resulting destruction of all vegetating bacteria. The spores of the gas bacillus resisting this temperature, they may be transferred to culture-media and incubated anaërobically. Pure cultures may frequently be obtained in this way. A more reliable method consists in the intravenous inoculation of a rabbit with an emulsion of the suspected material, killing the animal within five minutes. If the body be kept at room temperature or at 37° C. for a few hours the organisms develop rapidly, producing typical changes in the internal organs, from which, as well as from the blood, they may be obtained in pure culture.

Pathogenic Action.—The gas bacillus is the sole cause of gaseous phlegmon or emphysematous gangrene following upon wounds of the cutaneous surfaces, particularly gunshot wounds. It is responsible for a number of infectious processes in woman, and is especially important because of its frequent invasion of the uterus during the puerperium. In this organ it may cause the distention of the uterine cavity with gas (physometra), or emphysema of the uterine wall. It may cause an acute uterine infection resulting in invasion of the blood and organs (Williams), and it may be transmitted to the fetus with the production of a fetal emphysema (Dobbin). It is probably the cause of all the deaths attributed in the older literature to the introduction of air into the uterine sinuses during labor and in many of the recently reported cases the organisms have been demonstrated microscopically in the organs and tissues (Welch). It is especially prone to set up infection during criminal abortion, where the ordinary antiseptic precautions of the obstetricians are neglected. It may be the cause of renal and ureteral infections (Kelly), and it may be present in the tissues without the active evolution of gas (Harris).

Bacillus Tetani.—Observed by Nicolaier¹ in wounds resulting in tetanus and in garden earth, and obtained in pure culture by Kitasato.² It can usually be demonstrated microscopically in affected tissues, but is cultivated with some difficulty, being purely anaërobic. Morphologically, it is a small slender bacillus, measuring about one micron in thickness and staining by the usual methods. It is actively motile and possesses numerous flagella distributed uniformly about the bodies of the organism. It rapidly sporulates, the spore lying at one end of the rod, and somewhat greater in diameter than the rod itself, giving the appearance of a drumstick. These spores are exceedingly resistant and may live months and years. Kitasato has cultivated the organism from threads dried and kept for months. They are resistant to heat, a temperature of 100° C. killing them only after several minutes' exposure, and they are capable of development after exposure for an hour to a temperature of 80° C. Five per cent. carbolic acid destroys them only after an exposure of fifteen hours. The spores of this organism are

¹ Nicolaier: "Beiträge zur Aetiologie des Wundstarrkrampfes," 1885, Göttingen.

² Kitasato, S.: "Ueber den Tetanusbacillus," Zeitschrift f. Hygiene, 1889, Bd. vii, S. 225.

widely distributed in nature, the soil of certain localities always containing them. If introduced beneath the skin the organism develops locally, its pathogenic action depending upon the elaboration of a specific toxin which travels up the axis cylinders of the motor nerves and firmly unites with the nerve cells. Tetanus antitoxin, which is theoretically of great neutralizing power, has little curative effect, since it cannot be given until the toxin has combined with the nerve centers. Its prophylactic use in immunizing doses is indicated in punctured wounds of the subcutaneous tissues where much dirt has been ground beneath the skin.

Spirochæta Pallida.—Definitely described by Schaudinn and Hoffman,¹ but in all probability observed first by Bordet and Gengou.² Average length from 4 to 10 microns, varying in thickness 0.5 micron or less. Curved or spirally twisted like a corkscrew, three to twelve regular curves in each organism. Actively motile, rotating on its long axis and bending forward and backward. Flagella demonstrated by Loeffler's stain by Schaudinn.³ May be stained by gentian-violet, but usually requires some special dye for its demonstration, of which Gmies's eosin-azur solution is the best. This consists of twelve parts of eosin solution (2.5 c.c. 1 per cent. eosin and 500 c.c. water), three parts of azur No. I (1 : 1000 solution in water), and three parts of azur No. II (0.8 : 1000 solution in water). Has been observed in nearly all the lesions of syphilis, chancres on penis and hands, enlarged inguinal glands, condylomata, papules, macules, and pustules, and rarely in circulating blood. Not yet cultivated on artificial media, and probably belongs to the class of *protozoa*.

Actinomyces.—Discovered by Böllinger in the ox and named actinomyces, or ray-fungus, by Harz,—the cause of "lumpy jaw" in cattle. Macroscopically appears as small white, yellowish, or greenish granules in the pus. Microscopically made up of threads radiating from a center and presenting bulbous club-like terminations. The threads are from 0.3 to 0.5 micron in diameter, the clubs 6 to 8 microns. Stained by ordinary dyes; retains Gram's stain, cultivated with difficulty, growing only in agar and bouillon anaërobically. May rarely take part in puerperal infections. Has been observed once in this condition in the Johns Hopkins Hospital.

¹ Schaudinn and Hoffman: "Arbeiten a. d. K. Gesundheitsamte," Bd. xxii, Heft II, S. 527.

² Bordet, M. J.: "Demonstration d. un spirelle nouveau," Soc. Roy. des Sciences Méd. et Nat. de Bruxelles, 1905, lxiii, p. 124.

³ Schaudinn, F.: "Zur Kenntniss der Spirochæta pallida," Deutsche med. Wochenschrift, 1905, Nr. 42, S. 1665.

CHAPTER III.
PATHOLOGY OF THE REPRODUCTIVE ORGANS.

BY ELIZABETH HURDON, M.D.

DISEASES OF THE VULVA.

Diseases of the vulva may be classified as follows: (1) Malformations, (2) circulatory changes, (3) inflammatory diseases, (4) new growths.

MALFORMATIONS.

Absence of the whole vulva is found only in non-viable fetuses. It may be infantile in its development, a condition sometimes associated with infantile uterus, or the large or small labia may be absent or rudimentary. Hypertrophy of the labia is usually acquired, although sometimes developing in infancy. The clitoris is rarely absent. It may be rudimentary or bifid, and is sometimes greatly hypertrophied. Hypertrophy of the clitoris and labia has been found in some cases associated with adherent prepuce, and is thought by some writers to be the result of masturbation induced by this condition (Kinson).

Atresia of the vulva may be congenital or acquired. Congenital atresia of the vulva is probably rare, and most cases described as such are the result of an infantile vulvitis. In a case described by Howard A. Kelly¹ the well-formed labia majora were united by a thin, dark membrane which presented a well-defined vertical central raphe, only a small opening, 3 mm. in diameter, behind the clitoris representing the genito-urinary opening. The writer regarded this anomaly as an abnormally long fourchette. In the acquired cohesion there may be merely an epithelial union of the labia (Bokai) produced by the desquamation of the horny layers and agglutination of the deeper layers, but if the condition is neglected organization of the cohesion takes place. Dense scar tissue is found in the cohesion which follows severe infections of the vulva.

CIRCULATORY DISTURBANCES.

The many large veins in the vulva give rise to unusually severe lesions in cases of obstruction to the local circulation. Varicose veins and hematoma of the vulva occur chiefly during pregnancy and labor, but similar conditions are occasionally found accompanying large ovarian tumors, uterine myomata, and

¹ Kelly, H. A.: Operative Gynecology.

pelvic inflammation, or may be produced by external injuries (Fig. 45). Thrombi sometimes form in the dilated veins, and may become calcified, forming phleboliths. Rupture of a varicose vein may produce a large hematoma, and sometimes causes fatal hemorrhage.

INFLAMMATORY DISEASES.

Simple Vulvitis.—The most frequent form of vulvar inflammation is a diffuse erythema. The labia are swollen and reddened and are smeared with the abundant



FIG. 45.—VARICOSE VEINS OF LABIUM MAJUS (Johns Hopkins Hospital).

secretion from the sebaceous glands. Microscopically the epithelium is loosened and swollen, and there is a round-cell infiltration of the papillae and the corium. The simple erythema is sometimes associated with a herpetic eruption characterized by the development of small vesicles. In rare instances a pustular eruption (impetigo herpetiformis) develops during the puerperium. These simple inflammatory affections are usually due to chemical irritants, such as urine, sweat, or an irritating uterine discharge, and are common in diabetic subjects.

Gonorrheal Vulvitis.—

The most intense inflammation is found in gonorrheal infection of the vulva. The large and small labia and the mucosa of the vestibule, espe-

cially in the vicinity of the clitoris, are swollen, reddened, and bathed in a thin, irritating, purulent exudate, which becomes dried, forms yellowish crusts, and often produces excoriations. The most severe conditions are often seen in young children, whose delicate mucous membranes are readily infected; and, as a result of infantile gonorrheal vulvitis, adhesions and atresia often remain.

The chronic gonorrheal infection which often persists after the subsidence of the acute process is characterized by the presence of a more or less copious purulent discharge, associated with some redness of the mucous surfaces, especially about the urinary meatus and the ducts of the vulvovaginal glands.

Condyloma Acuminata.—This is a characteristic affection of the vulva due to a chronic inflammatory process, usually of gonorrheal origin. It develops more or less frequently in the form of small, pointed, firm, warty excrescences, usually collected in groups, which may unite to form a cauliflower-like mass as large as a man's fist. The warty excrescences may be situated upon the large or small labia, the clitoris, the perineum, or around the anal margin (Fig. 46). Histologically, the affection is essentially characterized by a hypertrophic elongation of the papillæ, which are covered with the thickened, but otherwise practically normal, surface epithelium. The connective tissue is generally infiltrated with a moderate number of small round cells.

Bartholinitis.—Inflammation of Bartholin's glands is almost without exception due to gonococcus infection. In some cases the infection is limited to the duct, and is recognized by the intense reddening about the mouth of the gland. When the gland itself is infected, an easily palpable, tender swelling is found in the posterior part of the labium majus. Suppuration of the gland is said to occur only when there is a mixed infection of gonococcus and micrococcus. Bartholinitis is rare in the gonorrheal infection of children.

Vulvitis Phlegmonosa.—This condition is most frequently found in puerperal infections. It is characterized by intense swelling and induration of the parts, and under the microscope the deeper tissue as well as the superficial layers are infiltrated with a serous exudate and leukocytes.

Erysipelatous vulvitis is due to streptococcic infection. The disease is rare, but is relatively frequent in infants, especially following a streptococcic infection of the umbilicus. The condition is characterized by swelling, intense reddening, and the presence of the characteristic line of demarcation.

Vulvitis Ulcerosa Puerperalis.—These ulcers are usually situated in the frenulum and are due to the infection of lacerations or other injury of the tissue occurring during delivery. The ulcers have infiltrated margins and grayish or brownish discolored floors. They are often covered with a pseudo-diphtheritic membrane.

Diphtheria of the vulva is a rare condition due to infection with bacillus diphtheriæ. It occurs chiefly in children with pharyngeal diphtheria, but has also developed as a primary infection during the puerperium. The disease may be very severe, and according to its severity it produces lesions varying from a circumscribed superficial ulceration to extensive necrosis or even complete gangrene of the vulva.

Syphilis.—The primary invasion of the spirochæta pallida takes place almost exclusively in the mucous membrane of the vulva. The central lesion appears as a circumscribed induration under the epithelium, which is produced by a peri- and endo-arteritis associated with a round-cell infiltration of the surrounding tissue, and the development of epithelioid and occasional giant cells. The proliferation of the intima may result in obliteration of the vessel lumen. The increasing infiltration and necrosis of the tissue causes degeneration of the surface epithelium and produces an ulcer having undermined margins and a gray

necrotic base. The character of the primary chancre varies somewhat according to its location. On the clitoris and nymphæ it forms a circumscribed hard induration, whereas in the labium majus the tissues are diffusely infiltrated, edematous, and discolored. More rarely the primary lesion appears in the form of a soft vegetative growth, which may be slightly constricted at its base.

Condyloma Syphilitica.—Secondary syphilitic lesions of the vulva appear as broad, flat, warty elevations, usually surrounding the thickened hypertrophied labia (Fig. 47). The surface

is moistened by the transudation and presents slight superficial ulcerations. The exudate is exceedingly infectious. Microscopically, there is found a hypertrophy of the papillæ, a general serous and round-cell infiltration of the connective tissue, and vascular degeneration.

Elephantiasis of the vulva, as it is seen in temperate climates, is usually of syphilitic origin. It is characterized by great hypertrophy and brawny induration of the parts, which often present a fissured, lobulate surface. The disease may affect the clitoris, labia minora, or labia majora. The microscopic appearance is similar to that of the syphilitic condylomata.

Syphilitic lesions of the vulva may be mistaken for simple ulceration, tuberculosis, or neoplasms. The undermined edges of the ulcerated chancre are



FIG. 46.—CONDYLOMA ACUMINATA (Johns Hopkins Hospital).

usually distinctive; moreover, the history and clinical course of the disease usually indicate its specific nature. If, however, an early diagnosis is essential, a histologic and bacterioscopic examination may be necessary. Syphilitic condylomata may simulate a carcinomatous growth, but may usually be differentiated by the brawny consistency, more diffuse character, and less sharply marked edges. The surface, moreover, is less friable and does not bleed readily.

Tuberculosis of the vulva is much less frequent than was formerly supposed, as many of the affections described as tuberculosis or lupus of the vulva are now

known not to be due to invasion by the tubercle bacillus. The disease is usually secondary to a pulmonary infection, or to disease of the pelvic organs or bladder. A few cases have been described in which the local infection was undoubtedly



FIG. 47.—ELEPHANTIASIS OF THE CLITORIS AND LABIA MINORA (Johns Hopkins Hospital).

primary. These cases, for the most part, occurred in young children and could be traced to contamination from tuberculous parents or companions.¹ The disease appears usually in the form of chronic ulcers having irregular infiltrated edges

¹ Demme: "Beitrag zur Tuberculose des Kindesalters," Wien. med. Blät., 1887, Bd. I.

and bases covered with a puriform secretion and studded with minute grayish tubercles. More rarely the tubercular affection appears as a vegetative hyperplastic outgrowth which may closely simulate an early carcinoma or may resemble the pointed condylomata; or, again, there may be a general hypertrophy and edema of the part, producing a pseudo-elephantiasis.¹ The hyperplastic growth is regarded by some writers as the product of a chronic irritation, not of a specific nature but probably due to a mixed infection. A formation of dense, cicatricial tissue and fistulous tracts sometimes occurs in chronic tubercular vulvitis.

Histologically, the characteristic caseous surface of the ulcer and the presence of typical giant-cell tubercles make the diagnosis clear. Tubercle bacilli may be found in the tissues and occasionally in the secretion, but are often scanty.

Chronic ulceration of the vulva (*esthiomène*) is a chronic inflammatory infiltration of the vulva accompanied by an indolent ulcerative process. Giant cells are found in the tissues, but there is no caseation. The etiology and pathology of this somewhat rare affection are obscure. It was formerly believed to be a tubercular condition, but the investigations of MacDonald, Duncan, Dubreuille, and others, seem to show that it is a non-specific affection. Unna, and more recently Pichevin, hold a similar view. Weinlechner considers it a tubercular infection in a syphilitic subject and claims to have discovered the tubercle bacillus in the suspected mass. Günther's three cases² were in syphilitic individuals. Pozzi, Küstner, and others, regard it as tubercular (Pichevin³).

Atrophy of the vulva may occur as a senile change or may be the result of chronic disease. Simple atrophy of the vulva occurs in old age and is a physiologic condition chiefly marked by a disappearance of the adipose tissue.

Kraurosis vulvæ is a disease of advanced life which is characterized by the development of either a localized or general shrinkage or atrophy of the parts, and in its severest form results in the disappearance of the individual parts. Its chief characteristic consists in a hardening and drying of the superficial tissues. The surface of the affected area is reddened, shrunken, very dry and brittle, and often excoriated. The large and small labia, clitoris, vestibule, and anal region may all be involved in the diseased process. The etiology and pathogenesis of the affection are not definitely understood, but the majority of writers agree that the shrinkage of the tissue is an advanced stage of a hyperplastic inflammatory process. Orthmann⁴ found both the hypertrophic and atrophic stages present in his specimens. The surface epithelium in places was thinned out so that the horny layer rested directly on the corium, and the papillæ had disappeared. On the other hand, the tissues about the margins of the affected areas were hypertrophic and infiltrated with small round cells. Gebhard⁵ found only an atrophy of

¹ Mlle. M. Bonnin: "Tuberculose de la Vulve," Thèse, Paris, 1900.

² Günther, E. E.: "Report of Three Cases of Esthiomene," Amer. Jour. Obstet., 1904, vol. xlix, p. 373.

³ Pichevin: "Esthiomène de la Vulve," La Sem. Gyn., 1905, T. x, p. 38.

⁴ Orthmann, S. D.: "Ueber Kraurosis Vulvæ," Zeit. f. Geb. u. Gyn., 1890, Bd. xix, S. 283.

⁵ Gebhard: "Pathologische Anatomie und weibliche Sexualorgane," 1899.

the tissue in his specimen, while Peter, studying an early case, found atrophy of the elastic tissue of the corium in the affected area, and hypertrophy and hyperplastic processes in the surrounding tissue, with a tendency to cicatricial shrinkage. Jung¹ regards the disease as only the final stage of a chronic vulvitis and not a clinical entity.

Leukoplakia (ichthyosis, leukokeratosis) was first described by Weir in 1875.² It is an affection characterized by the formation of dense white plaques on the mucocutaneous covering of the vulva, and, more rarely, on the mucous membrane of the vagina or uterus, and is analogous to similar conditions affecting the buccal mucous membranes (Reclus). It is due to a thickening of the epithelial layers, especially the stratum granulosum, accompanied by thickening and infiltration of the corium.

The disease affects the labia minora, the clitoris, the prepuce clitoridis, and the inner surface of the labia majora. The plaques may be simple, sometimes a single large area covering an entire labium. More often there are several plaques, connected by bands of less-accentuated leukokeratosis. The more recent areas are opalescent and transparent, the older lesions are opaque and hard and dry to the touch. The etiology is obscure. Syphilis seems to be definitely excluded in many cases. An antecedent vulvovaginitis is probably an important causative factor. Certain constitutional diseases, such as diabetes, gout, etc., have been associated with the affection, but an etiologic relationship is not clear. Perruchet³ describes a case of leukoplakia succeeding an intense vulvitis which developed during the puerperium.

The course of the disease is essentially chronic. It may persist indefinitely and may possibly undergo retrogressive changes. *The most important sequel is the development of carcinoma, which occurs in a considerable number of cases.*

Pruritus is a manifestation of various morbid processes and cannot be regarded as a pathologic entity. The source of the local irritation is often some constitutional disease, especially diabetes, and in other cases irritating uterine secretions or urine may produce the local affection. The pruritic affection occurring in old age, and more properly termed vulvitis pruriginosa, is a subacute inflammation involving the deeper layers of the corium and the nerve-endings.

TUMORS.

Tumors of the vulva include cysts, benign fibrous-tissue tumors, carcinoma, and sarcoma.

Cysts of the vulva are frequently observed. The majority are situated in the labia majora and are due to a cystic dilatation of Bartholin's glands, usually the result of a preceding inflammation which has occluded the orifice. The cyst may

¹ Jung, P.: "Kraurosis Vulvae," Zeit. f. Geb. u. Gyn., Bd. lii, p. 13, 1904.

² Weir, R.: "Ichthyosis of the Tongue and Vulva," N. Y. Med. Jour., 1875, p. 246.

³ Perruchet: "Un Cas de Leucoplasie vulvo-vaginale," La Gynecologie, 1904, t. ix, p. 31.

develop in either the duct or the body of the gland. The duct cysts, which are the most frequent, are situated in the lower third of the labium majus and are oval or rounded in shape. The cysts of the gland proper are spherical in shape, are more deeply placed, and have a tendency to expand in the loose tissue between the vagina and rectum, or between the vagina and urethra. They may

sometimes be confused with cysts of Gartner's duct. The cysts usually contain clear serous fluid, but in some instances the contents are turbid, owing to the presence of blood, degenerated epithelium, leukocytes, and cholesterol. Pick¹ describes a papillary cyst of the labium majus.

Cysts of the labia minora sometimes



FIG. 48.—A SECTION OF A CYST OF THE DUCT OF BARTHOLIN'S GLAND.

The dilated duct (a) is lined in part with multiple layered epithelium (b) of the transitional type, and partly with a single layer of cylindrical cells (d) or low columnar cells (e). A gland acinus apparently opens into the duct at (c). The normal acini indicated by (f) and (g) are lined with high cylindrical cells with basal nuclei. (After T. S. Cullen.)

are due to retention of the secretion in the sebaceous glands.

¹ Pick, L.: "Ueber Adenocystoma papilliferum Vulvae Polyposum," *Frommel's Jahrbuch*, 1903, p. 276.



FIG. 49.—MULTIPLE FIBROMATA OF THE LABIUM MAJUS. (Case of Dr. Coates, Cleveland.)

result from a serous transudation into the space between adherent folds of mucous membrane. The majority, however, are atheromatous cysts and

Adenoma of the vulva, originating from rudimentary sweat-glands, is described by Pick,¹ who has seen two cases in Landau's clinic. The tumors are small wart-like outgrowths varying in size from a pea to a cherry-stone.

Fibromata originate in the fibrous tissue of the large or small labia. They appear as hard, round, circumscribed nodules, covered with the normal skin or mucous membrane. As it increases in size the tumor becomes more prominent, and may finally draw out the loose tissue so as to form a pedicle. The tumor may consist of a single nodule or several nodules collected into a single mass (Fig. 49). It may be of enormous size, sometimes hanging down to the patient's knees. The tumor is usually hard, but may be softened on account of extreme edema, or may even be cystic as a result of lymphangiectasis. Borreman² described an edematous fibroma of the vulva, the size of an infant's head, which resembled a lipoma in consistency.

Histologically, the growth is composed of a dense, fibrillated, poorly vascularized stroma containing spindle-shaped or fusiform cells having spindle-shaped vesicular nuclei of uniform size and staining properties.

Myomata, enchondromata, and neuromata of the vulva have been described, but are exceedingly rare. Fromme³ describes a case of fibrolipoma myxomatodes containing gland elements.

Lipoma of the vulva is a rare affection and few cases have been reported. It occurs at any age and may even be con-



FIG. 50.—LIPOMA OF THE LEFT LABIUM MAJUS (Johns Hopkins Hospital).

¹ Pick, L.: "Ueber eine besondere Form nodulärer Adenome der Vulva," *Arch. f. Gyn.*, Bd. lxxi, 1904, S. 347.

² Borreman, Ch.: "Fibrome vulvaire," *La Sem. Gyn.*, 1905, T. x, p. 38.

³ Fromme: "Gutartiger Geschwulste in das grossere Labien," *Monatsch. f. Geb. u. Gyn.*, 1904, Bd. xx, S. 961.

genital. The tumor consists of adipose tissue with a variable amount of fibrous tissue, the hardness or softness of the mass depending upon the proportions in which these tissues are present. The outgrowth develops in the adipose tissue of the labium majus or of the mons veneris, and appears as a well-defined oval or round, soft or rather firm, usually pedunculate mass hanging down from the labium (Fig. 50). The skin overlying the tumor is generally smooth, but may be wrinkled or slightly lobulate. Decubital ulcers frequently develop on the surface of the mass (Kelly).¹

Carcinoma of the external genitals is one of the rarest forms of carcinoma observed in gynecologic practice. It is preëminently a disease of advanced life, usually occurring between the ages of forty-five and sixty. The tumor may originate in the epithelial covering of the vulva or in the vulvovaginal glands. The



FIG. 51.—PRIMARY ADENOCARCINOMA OF THE LABIUM MINUS.

former is the more frequent. The parts most frequently affected are the labia majora; less frequently the labia minora, the prepuce, and the clitoris. The tumor may appear as a circumscribed prominence, as a deep ulceration with infiltrated margins, or as a diffuse infiltration. The circumscribed growth consists of a firm, round, or ovoid tumor projecting from the surface of the vulva, and more or less movable over the subjacent tissues, which, however, are infiltrated to a variable degree. In Fig. 51 a small indurated ulcer is seen on the inner surface of the left labium majus where it comes in contact with the growth. The surface is a bright red, sometimes smooth, but generally irregular, slightly roughened and furrowed, and sometimes covered with little papillary elevations. At a later stage the tumor consists of a hard, friable, lobulate or warty mass infiltrating the skin and showing more or less extensive ulceration. The cancer

may from the beginning invade the deeper tissue, and undergoing early necrosis appears as a crater-like ulcer with infiltrated margins and a necrotic, irregular base.

The diffuse infiltrating cancer invades the subcutaneous and deeper tissues of the vulva, without forming a circumscribed nodule. The tissue becomes exceedingly hard and more or less thickened. Very soon superficial ulceration occurs and an irritating, fetid, watery fluid is secreted. The disease may not progress rapidly and may remain almost stationary for some time. In a case personally observed in a woman of seventy-five, the tumor, which involved the vestibule and upper portion of the labia majora and minora, had started as a small nodule five years previously. The usual tendency of the growth is to extend up over one side

¹ Kelly, H. A.: "Lipoma of the Vulva," Johns Hopkins Hospital Reports, vol. iii, p. 321.

of the vulva, across to the opposite side, and outward on to the skin surface. It seldom invades the vagina. "Inoculation" growths upon the opposite side are not uncommon. The growth may metastasize early, the occurrence of metastases not depending upon the size nor duration of the primary focus. The following glands may be involved: In cancer of the labium majus, the inguinal glands and occasionally glands along the course of the lymph-channels between the labia and the inguinal regions; cancer of the prepuce, labia minora, clitoris, and vestibule may metastasize to the inguinal, the retrocrural, or suprapubic gland, or may proceed directly to the pelvic glands. Free anastomoses exist between the lymphatics of the two sides, so that a tumor of one side may metastasize to the glands of the opposite side.

Histologically, cancer of the vulva presents the usual appearance of squamous-cell carcinoma (see Cancer of the Cervix) and consists of an atypical proliferation of the squamous epithelium. A striking difference, however, noticed between cancer of the vulva and cancer of the vagina and cervix is the occurrence in the former of abundant "cancer pearls" due to the horny degeneration of the centers of the epithelial nests. In some cases, however, the vulvar cancer, instead of forming large epithelial nests which gradually undergo keratinization or necrosis, rapidly invades the tissue in the form of slender columns of cells which branch and anastomose in all directions.

Carcinoma of Bartholin's gland appears as a circumscribed tumor about the size of an egg or an orange, situated in the labium majus. It may be very dense, or is elastic and fluctuating, simulating a cyst of the gland. There are usually large vessels in the overlying skin. Histologically, the tumor presents an alveolar structure consisting of masses of epithelium, or of irregular, atypical glands surrounded by a vascular connective-tissue stroma.

Sarcoma of the external genitals is exceedingly rare. The tumor consists of a nodular mass which may be only 3 or 4 cm. in diameter, or may be as large as a man's head. It may be attached to the vulva by a broad base or may be slightly pedunculate. Histologically, round and spindle-cell growths, myxosarcoma, and melanosarcoma have been described.

DISEASES OF THE VAGINA.

Diseases of the vagina include malformations, injury, inflammatory diseases, and neoplasms.

MALFORMATIONS.

As the vagina is developed from the coalescence of the lower portion of the Müllerian ducts, complete failure, arrest, or imperfection in the development of the ducts may result in the complete absence or atresia of the vagina, or the formation of a double or septate vagina.

Congenital absence of the vagina and complete atresia are often difficult to differentiate, but the question is not of practical importance, as the condition is often accompanied by other developmental errors of such a grade that surgical

interference is not necessary; or if a well-developed uterus is present the operation for the relief of retained menstrual fluid is similar in either case. The chief difference is that in atresia a band of fibromuscular tissue is found between the rectum and bladder, while in absence of the vagina these structures are in direct contact.

Atresia affecting only a portion of the vagina, usually the lower part, is comparatively common and may be congenital or acquired. According to some writers, notably Nagel, most cases of atresia, even in the new-born, are not strictly developmental anomalies but are the result of intrauterine adhesions. In other cases the atresia develops in early extrauterine life and presents various etiologic factors. The most common is an infantile vulvitis due to gonorrheal infection or following the acute infectious diseases, especially diphtheria and measles. Traumatism is an occasional cause in early life, and at a later period, traumatism occurring during childbirth may produce atresia. As in the case of vulvar atresia, there may be simply an epithelial union of the two surfaces, or there may be a thin membrane situated immediately behind the hymen; while, again, the atresia extends upward for 3 or 4 cm. or involves the entire vagina and portio vaginalis, and the bladder and rectum are separated only by a thin fibromuscular septum.

With the establishment of menstruation the menstrual blood accumulates behind the septum, distending the upper vagina (hematocolpos) and then the uterus (hematometra). Hematosalpinx is believed by many to occur only when the abdominal ostia have been previously sealed and hence is found only in cases of acquired or inflammatory atresia. A thin septum in the anterior vagina becomes stretched and bulging with the menstrual accumulation and may finally rupture. A more extensive atresia is not affected in this way and usually presents a slight depression externally, while the tumor develops in the pelvis and lower abdomen.

Double vagina is characterized by the presence of a longitudinal septum, usually falciform in shape, which may extend the entire length of the vagina or may be found only in the upper, middle, or lower third. One-half of the double vagina may be atritic while the other is patulous, in which case, if the corresponding uterine horn is developed, a unilateral hematocolpos may form. A variety of vaginal cysts, described by Freund and Kleinwachter,¹ is caused by the distention of a rudimentary vagina in the wall of a well-developed one.

The hymen is generally regarded as developing from the lower end of the vagina, and, therefore, is usually absent in cases of complete absence of the vagina, and is double in cases of double vagina. The occasional presence of a normal hymen in cases of absent vagina is explained by the theory of the development of the hymen from double lamellæ, an inner developing from the vagina and an outer from the vulva. Gellhorn's² investigations, however, seem to disprove the bilamellar development of the hymen. Imperforate hymen is rare. Double orifices without other anomaly are frequently seen, and in other cases there are several sieve-like openings

¹ Cullen, T. S.: "Vaginal Cysts," Trans. Am. Gyn. Soc., 1904.

² Gellhorn, G.: "The Hymen, Anatomy, etc.," Am. Jour. Obst. No. 50, p. 145.

(cribriform hymen). Variations in the shape of the normal hymen are too well known to need detailed description.

INJURY.

Almost all important injuries to the vagina and perineum arise during parturition and are caused either by the fetal impact or by instruments used in delivery. Similar injuries may occur during the removal of large uterine myomata. Injuries from without are comparatively frequent in children, but rare in adults. A variety of accidental causes, such as falling upon a paling or chair post, being gored by cattle, etc., have been known to produce severe injuries, even complete tear of the rectovaginal septum with extensive laceration of the upper part of the vagina. It is to be borne in mind that tears of the vaginal wall above the outlet may occur without external evidence of injury. As a result of injuries the normal contractile tissue of the vaginal wall is partly replaced by scar tissue and the outlet is widened. A condition is then present which is favorable to prolapse of the anterior or posterior vaginal walls.

Prolonged pressure of the fetal head may not only cause severe vaginal laceration, but produces extensive necrosis of the tissue, which may result in the formation of a urethrovaginal or vesicovaginal fistula. Rupture of the upper posterior wall is rare.

Prolapse of the vaginal walls may affect either the anterior or posterior wall alone or may involve the entire vagina. It may be caused by conditions existing in the vaginal walls, or may be secondary to descensus of the pelvic organs. The first form is characterized by prolapse or ectropion of the lower portion of the vaginal wall, while in the second form, the superior portion descends and there is more or less complete inversion of the vagina (Gebhard).

INFLAMMATORY DISEASES.

Vaginitis.—Inflammation is the most frequent pathologic condition affecting the vagina. It is, however, more common relatively in children than in adults, probably on account of the greater vulnerability of the delicate mucous membrane in children. Vaginitis is a frequent result of gonorrheal infection in children, but is rare in adults. In children also the acute infectious diseases are often accompanied by a severe form of vaginitis, sometimes terminating in gangrene and sloughing. Inflammation of the vagina is always directly due to bacterial infection, although traumatic, chemical, and thermal influences, as well as trophic disturbances, may prepare the way for the bacterial invasion. The most frequent invaders are the ordinary pyogenic microorganisms, gonococcus, bacillus diphtheriæ, bacillus tuberculosis, spirochæta pallida. A gas-producing bacillus, probably the bacterium Welchii, is found in some cases of colpitis. The pathologic condition resulting from the activities of these different microorganisms, with the exception of the last

three, are not always distinctive, and vary according to the virulence of the infectious agent and the tissue's power of resistance. A classification of the various forms of vaginitis cannot, therefore, be based entirely upon the etiology of the disease, but must depend upon its pathologic anatomy.

Acute vaginitis may be of a mild or a severe grade. In the early stages of the affection the vaginal mucosa is reddened, swollen, and granular and is bathed in an abundant seropurulent exudate. In severe cases, as the disease progresses, the swelling and hyperemia increase and small excoriations may occur. The irritation of the secretions or the presence of a foreign body may produce necrosis and deep ulceration. There may be a purulent infiltration of the tissue, which develops into a general phlegmonous condition, and finally results in complete destruction of the tissue. A pseudo-diphtheritic inflammation occurs in puerperal conditions and is a not uncommon complication of the acute infectious diseases. It is characterized by a marked swelling of the tissue, which is covered with a whitish-gray or greenish deposit, or by a typical false membrane composed of the necrotic superficial portion of the mucosa. In extreme cases there may be extensive gangrene. Various pyogenic organisms have been obtained in these cases. True diphtheritic infections, caused by the Klebs-Loeffler bacillus, and amenable to serum therapy, have also been described.

Erysipelatous vaginitis, resembling erysipelas of the skin, is a grave form of vaginitis which fortunately is rare. The disease invades the paravaginal tissue as a phlegmonous infiltration or as a septic lymphangitis and may involve the entire pelvic tissue, the parametrium, and pararectal tissue, and finally produce a septic peritonitis.

Chronic vaginitis may succeed an acute inflammation or may be chronic from the outset. It is frequently caused by the irritation of foreign bodies, such as pessaries. The disease is not usually general, but may affect a large portion of the mucosa, which is reddened, often mottled with slight ecchymoses, or brownish and pigmented. The surface may be granular, or is smooth, dense, and somewhat glazed. Under the microscope the surface epithelium is often somewhat thinner than normal, while the subcutaneous tissue is dense and fibrous and is infiltrated with small round cells occurring in clumps or diffusely distributed. A deposit of blood pigment is often noticed.

Vaginitis condylomatosa.—In long-continued irritations, especially as a result of gonorrheal infections of the cervix, urethra, or vulva, but also with other chronic irritants, condylomata similar to, but not so thickly set as those found in the vulva, develop and are sometimes distributed over the entire vagina. The condition is characterized by a hyperplasia of the papillæ, which become elongated and thickened, accompanied by a secondary epithelial proliferation.

Senile vaginitis is a chronic inflammation peculiar to old age when the vaginal mucosa is atrophic and poorly nourished. An irritating uterine or cervical discharge, or other irritant, excites an inflammatory reaction which frequently results in the production of small ulcers which may gradually enlarge. In the healing of

these ulcers dense scar tissue develops and adhesions form between the different ulcers. The rupture of superficial vessels results in small subepithelial hemorrhages.

Vaginitis emphysematosa occurs most frequently during pregnancy, but also occasionally during the puerperium, and is characterized by the presence of gas cysts in the subepithelial tissue. The cysts vary from a pea to a hazelnut in size, and on account of the attenuation of the epithelial covering may appear bluish in color. Histologically, they are found to have developed generally in the connective-tissue spaces, although a few may be partly lined with endothelial cells. In their immediate vicinity are numerous large foreign body giant cells, while in the deeper tissue below the cysts, similar cells surround small irregular spaces. The connective tissue in the neighborhood of the gas cysts is infiltrated with round cells and contains numerous young capillaries. A gas-producing bacillus without capsule has been isolated by Lindenthal, but it is highly probable that future investigations will show that the disease is due to the bacillus *aërogenes capsulatus* of Welch and Nuttall.

Tuberculosis of the vagina is extremely rare. It is usually secondary to tuberculosis of the vulva or uterus, but may extend from the rectum or may be the result of an embolic infection through the blood or lymph-channels. In a case described by Friedländer (Gebhard) the primary tuberculous ulcer of the vagina was apparently due to an infection conveyed through sexual intercourse. An autopsy performed on the individual later revealed no other tuberculous focus.

The disease appears in two forms, miliary and ulcerative. Tuberculous ulceration is the form usually observed. It consists of one or more flat circumscribed ulcers with infiltrated hyperemic margins, the base covered with yellowish-gray material or studded with miliary tubercles. Beyond the bright red margin of the ulcer the mucous membrane is normal. Histologically, the floor of the ulcer consists of granular caseous material, beneath which the tissue is infiltrated with typical miliary tubercles or diffuse tubercle tissue.

Tuberculous ulceration is to be distinguished from syphilitic ulcers, simple ulcerative vaginitis, and malignant tumors. In all cases where the slightest doubt exists a microscopic examination should be made.

In miliary tuberculosis the grayish-white tubercles are disseminated over the vaginal mucosa. They are sometimes fairly equally distributed, at other times more irregularly placed, and several nodules may coalesce to form a relatively large mass. Histologically, the characteristic discrete tubercles or diffuse tuberculous tissue are found as in tuberculosis of the vulva.

Syphilis of the vagina may occur in the form of chancre, ulcers, or gummata. These present the characteristics of syphilitic lesions elsewhere (see page 81).

Foreign Bodies.—The foreign body most frequently found in the vagina is a pessary. More or less serious injuries are produced when the pessary is too large, or when, owing to its composition, it causes an irritation of the mucous membrane, or, again, when it is left in too long. Extensive ulceration is often produced by the irritating foreign body, which may bury itself in the vaginal wall and even ulcerate

through into the bladder or rectum. Other foreign substances may be introduced by masturbation. Vesical calculi sometimes perforate the vesicovaginal septum and remain in the vagina.

Parasites are infrequent occupants of the vaginal canal, but the oxyuris and ascaris are occasionally found. Echinococcus disease of the neighboring structures may invade the vagina (Gebhard).

NEOPLASMS OF THE VAGINA.

New growths of the vagina, with the exception of cysts, are rare. They may originate from the epithelium or from the fibromuscular structures of the vagina and are benign or malignant. They include cysts, myomata, carcinomata, and sarcomata.

Cysts of the vagina may arise from (1) epithelial inclusions in scar tissue following injury; (2) vaginal glands; (3) embryonic structures in intimate topographic relationship with the vagina. The existence of glands in the vaginal wall has been amply proved by the observations of H. Hennig, v. Preuschen, Cullen, and others. They are usually situated in the upper portion of the vagina, but may be found in any part. The glands are lined with ciliated cylindric epithelium, and their ducts with squamous epithelium. The embryonic structures which may persist in the vagina are: (1) Gärtner's ducts in the lateral or anterior wall; (2) remains of Müller's duct, as when a rudimentary half of a vagina duplex is situated in the wall of the well-developed half; (3) misplaced ureter, sometimes found in cases of double kidney with double ureters. Gebhard also suggests that cysts may result from the adhesion of neighboring folds of the mucosa.

The cysts arising from these different structures vary considerably in size and in their histologic structure. The majority are small, averaging 10 to 15 mm. The largest may equal an infant's head in size. They are smooth, globular or cylindric, firm and elastic to the touch. The origin is sometimes obscure, but can usually be determined from the location of the cyst and the histologic structure of its walls.

Inclusion cysts develop from portions of the mucosa which have been included in the scar tissue resulting from laceration or injuries of the vagina or perineum. They are situated in the posterior or lower portion of the lateral walls and are usually small, varying from 5 or 6 to 20 or 25 mm. in size. They may be embedded rather deeply in the tissue, but often form a thin-walled hemispheric prominence. They are yellowish or whitish, and the content is turbid owing to the large amount of desquamated degenerated epithelium contained in it. The cysts are lined with stratified squamous epithelium; or, if the upper layers have desquamated, with a single layer of cuboidal or low columnar cells.

Cysts originating from vaginal glands are apparently infrequent, but as they cannot always be differentiated from inclusion cysts, their relative frequency cannot be determined. They may be found in any part of the vagina, are globular

in shape, and have clear or turbid contents. They may be lined with squamous epithelium derived from the duct of the gland, or with ciliated cylindric cells, or



FIG. 52.—SMALL INCLUSION CYSTS, EMBEDDED IN SCAR TISSUE IN THE POSTERIOR VAGINAL WALL. (After T. S. Cullen.)



FIG. 53.—CYST OF THE ANTERIOR VAGINAL WALL, PROBABLY ORIGINATING FROM GÄRTNER'S DUCT. (After T. S. Cullen.)



FIG. 54.—CYST OF THE POSTERIOR WALL OF THE VAGINA. (After T. S. Cullen.)

even with both varieties of cells. Small diverticula may be found in the wall of the principal cyst, or two or three cystic glands may appear side by side.

Cysts originating from Gartner's duct are comparatively frequent and are sit-

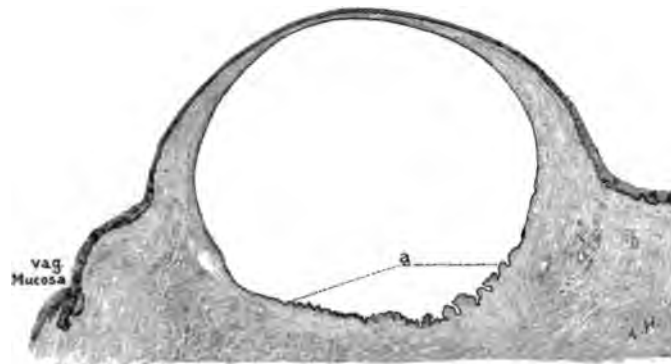


FIG. 55.—SECTION THROUGH A CYST TAKEN FROM THE ANTERIOR VAGINAL WALL ($\frac{1}{2}$ NATURAL SIZE).

The vaginal mucous membrane is very thin over the prominent portion of the cyst. The lining of the cyst is smooth excepting at (a), where it is thrown into irregular folds. The rugous condition at this point is due to the slight distensibility of the deeper structures of the vagina. (T. S. Cullen.)

uated in the lateral or anterior wall of the vagina. They are not perfectly globular, but are cylindric or funnel-shaped, corresponding to the long axis of the vagina in the direction of Gartner's canal toward the pelvis, and may be traced into the parame-

trium up to the region of the parovarium. If several patent segments of Gärtner's duct are separated by atretic portions, multiple cysts may develop. The cyst walls are of variable thickness; the contents a clear, straw-colored fluid. Histologically, the walls consist of fibrous tissue and smooth muscle and are lined with cylindric epithelium.

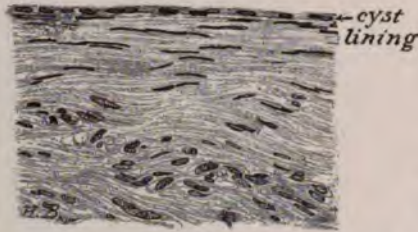


FIG. 56.—SHOWING CUBOID CELLS LINING SMALL CYST FROM POSTERIOR VAGINAL WALL. ($\times 200$.) (After Cullen.)

Cysts originating in remains of Müller's duct have been mentioned in connection with congenital anomalies of the vagina.

Cysts of the vagina originating in the blind end of a misplaced ureter have occasionally been found in the lateral or anterior wall and are recognized by their contents.

Cysts having no epithelial lining are occasionally met with. Their origin and pathogenesis are obscure. They may be the product of an edematous infiltration of the tissue; or, if endothelial-lined, may be due to a lymphangiectasis.

Cysts of the hymen are occasionally found and are usually congenital. Gellhorn collected 17 cases from the literature. They are exceedingly small, rarely exceeding a few millimeters, and the majority are situated on the external surface. They are lined with several layers of squamous epithelium or with a single layer of cylindric cells. They are simple retention cysts originating, according to some writers, from glands; according to others, from inclusions of mucous membrane between adherent folds, or between the two lamellæ from which the hymen is said to be developed.

Myomata of the vagina are not very rare. Potel¹ collected 150 cases. They consist of hard, round, nodular tumors, seldom exceeding 5 or 6 cm. in diameter, which project into the vaginal canal and are usually attached by a broad base, or are partly embedded in the wall. They are rarely pedunculate. The tumors are usually single, but may be multiple. They are generally separated from the underlying tissue by a distinct fibrous capsule, but occasionally a diffuse myomatous growth is observed. Histologically, the tumor is made up of smooth muscle bundles and connective tissue in variable proportions. Edematous degeneration of the tumor is frequent, and it is then softened and slightly elastic, and under the microscope the cells are swollen, palely stained, and hydropic. Other degenerations similar to those occurring in myoma of the uterus are less frequently found.

¹ Potel: "Le Fibro-myome du Vagin," Frommel's Jahrb., 1904, p. 290.

Cyst



FIG. 57.—SECTION OF THE WALL OF A CYST FROM THE LATERAL WALL OF THE VAGINA.

The cyst is lined with a double layer of low columnar epithelium. *a* is a section of a vaginal gland. (After T. S. Cullen.)

Malignant Tumors of the Hymen.—The only case of malignant new growth of the hymen on record is a sarcoma observed by Sanger¹ in a child of three years. As the hymeneal tumor was associated with a myxomatous growth of the vagina, it was possibly secondary to the vaginal tumor.

Carcinoma of the vagina may be primary or secondary. Primary cancer is comparatively infrequent, forming about 1 per cent. of the carcinomata of the generative organs. It is a disease of advanced life, but has been noticed as early as the twenty-sixth year. In a large proportion of cases the tumor follows a prolapsus of the vaginal walls with the consequent exposure to frequent injury, or is caused by the prolonged pressure and irritation of a pessary. Several cases have been reported in which a pessary, which had been worn continuously for many years, was completely embedded in carcinomatous tissue. Every gynecologist has experienced cases in which a pessary, retained for eight or ten years, was more or less deeply embedded in dense hyperplastic inflammatory tissue, and it is only surprising that cancer does not develop more frequently in such cases.

The new growth is usually situated in the posterior wall and appears as a circumscribed ulcerated induration varying from 1 to 3 or 4 cm. in diameter. The edges are sharply defined, infiltrated, and injected. The surface of the growth is usually necrotic, but often exhibits small papillary or nodular elevations. In an early stage the tumor is fairly movable, but very soon becomes slightly or firmly adherent to the deeper tissues, and on palpation it will often be noticed that it extends further under the mucosa than is apparent from the surface aspect. The mucous membrane surrounding the tumor is congested and inflamed, and is frequently excoriated by the irritating discharge. Instead of the circumscribed ulcer a diffuse infiltrating growth is sometimes found. In one case, in an unmarried woman of fifty, who had suffered from a slight leukorrheal discharge for nearly a year, I found that about 1 cm. within the intact normal hymen, the vagina was completely encircled by an indurated nodular infiltration and converted into a rigid tube which scarcely admitted the examining finger and was firmly adherent to the deeper structures.

Both the superficial and deep extension of carcinoma of the vagina are extraordinarily rapid, and the paravaginal and parametrial tissues are soon invaded, while extension to the retroperitoneal glands by way of the lymph-channels frequently follows. If the lower portion of the vagina is affected, the inguinal glands may be invaded. Extension to the rectum, more rarely the bladder, also occurs. A growth in the vault may extend to the portio vaginalis, but it is often difficult in these cases to determine whether the disease started in the vagina or cervix. The tumor may also extend downward to the vulva. Histologically, all the cases of primary cancer of the vagina described have originated in the squamous epithelium and present the characteristic picture of squamous-cell carcinoma. The surface epithelium may be very little thickened and a large part of it may be necrotic, but at the margins of the growth there is a lengthening

¹ Sanger, M.: *Archiv. f. Gyn.* Bd. xvi, S. 56.

of the interpapillary process, which gradually becomes branched, anastomosed, and invades the underlying tissue. The epithelial nests in the stained section usually stand out in sharp contrast to the normal epithelium on account of their deeper color, due to the closely packed cells, relatively large nuclei, and hyperchromatoses. If tissue from the necrotic area only be examined it is possible that the real nature of the disease may not be discovered, as the specimen may consist almost wholly of inflammatory products.

Secondary carcinoma of the vagina may be due to extension by continuity from a growth of the cervix or vulva, or to implantation or metastatic growth from a tumor situated higher up in the genital tract. A cancer of the rectum may directly invade the posterior vaginal wall. Implantation or metastatic growths may be mistaken for a primary tumor. In one such case a cancerous nodule about 3 cm. in diameter was removed from the vaginal wall, and the existence of a primary focus in the body of the uterus was not suspected until the patient returned, a year later, suffering from advanced uterine carcinoma. The fact that in this case the vaginal tumor was an adenocarcinoma should have suggested the probability of its secondary nature.

Chorioepithelioma of the vagina has been observed a number of times and may constitute the only apparent focus of the disease. Some writers regard the vaginal tumor as a direct implantation upon the vaginal walls from the canal, but others incline to the view of Schmauch¹ that it develops through transplantation of the tumor by way of the blood-vessels. The tumor appears as a dark reddish or brownish mass having a fairly smooth or slightly necrotic surface, its essential characteristic being the presence of large blood-spaces accompanied by a very scanty friable stroma. Histologically, the most characteristic features are often the entire absence of organized tissue in the tumor and the presence of multinucleated protoplasmic masses and large clear cells embedded in fibrin and blood. (For a more detailed description of the Chorioepitheliomata, see p. 159.)

Sarcoma of the vagina is rare in adult life, but it is a relatively frequent disease of early childhood, and is sometimes congenital. The tumors have not only two distinct periods of development, but those developing in early life differ both in their histogenesis and in their pathologic anatomy from those observed in adults.

Sarcoma of the vagina in children is apparently a congenital growth. A few have been noticed at birth and the majority develop during the first year of life. That in Ahlfeld's² case the tumor did not develop until the fifteenth year does not disprove the existence of a congenital *anlage*, and there may even have been a small latent tumor which had escaped observation. In Demme-Granicher's³ case a pea-sized nodule was noticed at birth, but did not show signs of active growth until the sixth year.

The tumor is especially characterized by the development of racemose clusters

¹ Schmauch: Amer. Jour. Obst., 1904, vol. 1, pp. 88 and 97.

² Ahlfeld: Arch. f. Heilk., Bd. viii, S. 560.

³ Demme-Granicher: Gränicher Inaug. Diss., München, 1888.

of dark red, hemorrhagic and pinkish-gray, translucent, vesicle-like polypi. It first appears as a small, rounded, broad-based, or more or less definitely pedunculate polyp, usually attached to the anterior vaginal wall. Its surface is smooth, and in every respect it resembles an ordinary mucous polyp. The primary tumor may remain quiescent for months or years, then suddenly begins to exhibit signs of rapid proliferation and the lobulate and polypoid masses develop. These become distributed over the vaginal mucosa, soon fill the entire canal, distend the outlet, and project beyond the vulva. The base of the tumor also becomes broader



FIG. 58.—SARCOMA OF THE VAGINA IN A CHILD 2½ YEARS OLD (RHABDOMYOSARCOMA). Showing the grape-like polypoid masses in the vaginal canal, the infiltrated vaginal walls, and the distended globular bladder. (Dr. C. Coue's case.)

and infiltrates the vaginal wall. A characteristic feature of the extension of the growth is the frequent penetration of the vesicovaginal septum and the development of an intravesical tumor. The cervix, uterus, and parametrium are next invaded, the vesical ends of the ureters involved, and hydroureter and hydronephrosis produced. Growths may develop upon the peritoneum and the iliac and lumbar glands are sometimes invaded. The rectovaginal septum is rarely penetrated. In general, the growth develops locally, invading only by continuity and contiguity of structure, but in a few cases distant metastases have developed.

Histologically, all the various types of sarcomatous tissue may be represented. In the periphery of the grape-like lobules, the tissue is exceedingly rich in cells, which are chiefly round and spindle-shaped, but giant forms are also found. Other areas, particularly at the base of the polyp, are less cellular and more fibrous, while

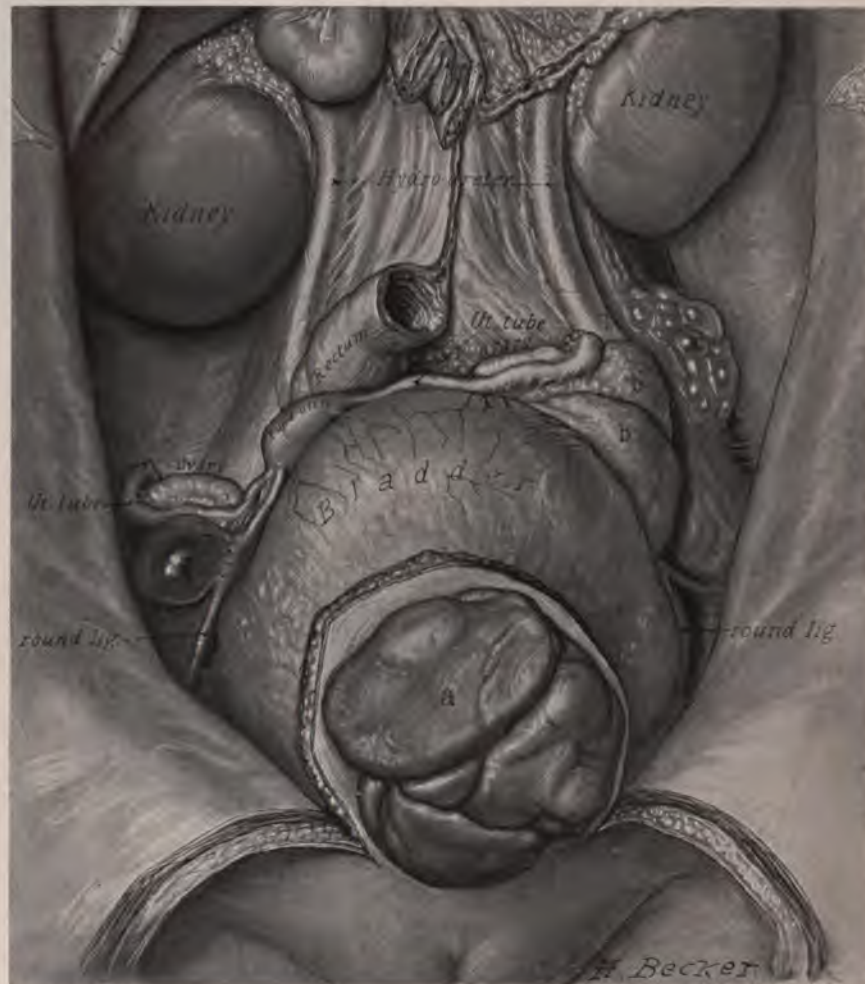


FIG. 59.—RHABDOMYOSARCOMA OF THE VAGINA WITH EXTENSION TO THE BLADDER AND PERITONEAL CAVITY.

The vesical tumor (a) is protruding through the suprapubic incision, made to relieve the retention of urine. Solid tumor masses in the parametrium are seen at (b), a cluster of translucent vesicle-like tumor masses at (c), and a large nodule attached to the right round ligament (d). Both ureters are dilated. (Same case as Fig. 58.)

other parts, again, in the center of the polyp, consist of a loose edematous tissue, poor in cells. In a considerable percentage of the recorded cases embryonic striated muscle fibers have been observed. According to Piquand,¹ these fibers correspond exactly to the striated muscle found in a three-months fetus. Gener-

¹ Piquand: "Sarcoma of the Uterus," *Rev. de Gyn.*, 1905, No. 9, p. 579.

ally, only a longitudinal striation is discernible, but occasionally transverse striæ are clearly defined (Fig. 60). The free surface of the vegetations are covered at first with the normal vaginal epithelium, but in a later stage there is usually considerable superficial necrosis. The nature of the tissue which produces the characteristic translucent appearance of the growth has not been definitely determined. It is considered by some histologists to be simply an edematous degeneration of the sarcoma, while others regard it as a true myxomatous tissue.

The secondary and metastatic growths may be translucent and myxomatous in appearance, or may consist of dense tumor masses. Under the microscope

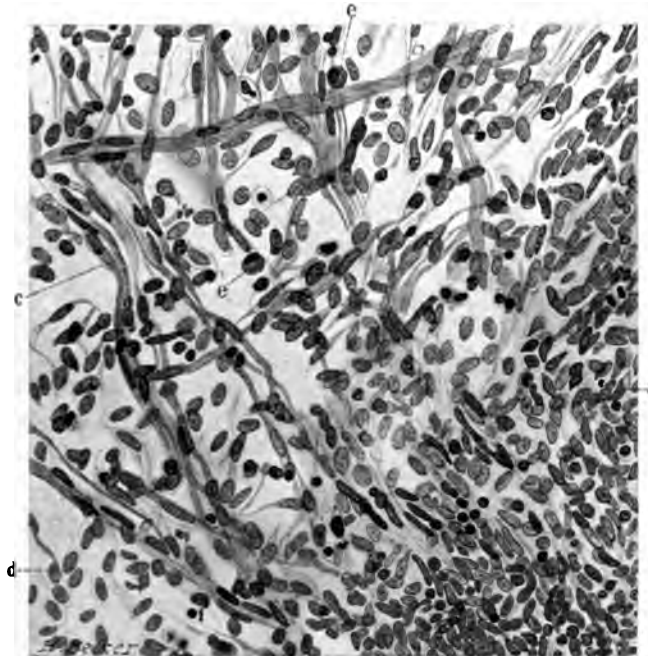


FIG. 60.—RHABDOMYOSARCOMA (400 diameters). SAME CASE AS FIG. 58.

The section shows on the right side cellular sarcomatous tissue (a), and on the left a loose meshwork consisting of long ribbon-like fibers with longitudinal and transverse striation (c). c, mitosis; d, indifferent embryonic cells; e, eosinophiles.

they may present the ordinary structure of round or spindle-cell sarcomata, or may have the polymorphous appearance of the primary tumor. In a case observed personally, the metastatic growths in the lungs contained striated muscle fibers.

Sarcoma of the vagina in adults is exceedingly rare. It may develop either as a circumscribed nodule or as a diffuse infiltration. In the first form the tumor appears as a rounded, somewhat firm nodule, usually broad-based, but sometimes developing a short pedicle. The surface in the beginning is covered with intact vaginal epithelium and is smooth or slightly lobulate. The tumor is sometimes softened, owing to hemorrhagic infiltration and necrosis. The second variety of sarcoma appears in the form of a diffuse infiltration of the vaginal wall and

may entirely encircle the lumen, producing a marked contraction of the canal. The sarcomata of adults originate in either the anterior or posterior wall; they do not often penetrate the rectal or vesical septa, or become widely disseminated locally. They have, however, on the other hand, a tendency to form early generalized metastases. Histologically, small round-cell and spindle-cell sarcomata are the most frequent forms. Boldt¹ has described a case of primary melanotic sarcoma of the posterior vaginal wall.

DISEASES OF THE UTERUS.

The pathologic conditions found in the uterus include (1) malformations and displacements; (2) injuries; (3) diseases of the endometrium due to trophic disturbances; (4) inflammation; (5) new growths. The diseases of the pregnant uterus will be considered only so far as they are of direct interest to the gynecologist.

MALFORMATION.

Malformations.—The uterus, with the vagina, is developed from the Müllerian ducts by the coalescence of their lower two-thirds and the absorption of their inner walls. The principal malformations of the uterus are produced by development defects occurring during early embryonic life, while the defects originating during the latter half of pregnancy include only such conditions as infantile uterus and hypoplasia (Roberts).² If the ducts fail to unite, either wholly or partially, or if the septum is preserved, there is a corresponding degree of malformation of the uterus. If the ducts become joined while the septum persists, the uterus presents the normal external appearance but possesses a double cavity. If the ducts do not unite, there are two more or less completely separated bodies. There are many degrees of deformity, varying from a slight depression of the fundus to the completely separate uterus and vagina.

Septate Uterus.—The most frequent type of deformity is caused by the preservation of the septum. The septum may extend only to the external os, through the entire body and cervix, into the vagina, but not completely dividing it; or it may completely divide the uterus and vagina.

Double Uterus.—In this class of cases the uterus is more or less completely divided into two distinct parts. In the first degree the fundus only is divided and externally presents a median groove (uterus bicornis arcuatus).

Double Uterus Bicornis.—In this condition there are two distinct uterine bodies communicating with the uterine tube at one end and the cervix at the other. The cervix may be single or double.

Uterus Duplex Separatus cum Vagina Separata.—This is an extremely rare condition and is due to the failure of union of the two ducts at any point.

Uterus Unicornis.—One of the Müllerian ducts may be well developed while the other is rudimentary or absent. The uterus unicornis results from the

¹ Boldt: "Primary Melanotic Sarcoma of the Posterior Vaginal Wall," Amer. Jour. Obst., Oct., 1906.

² Roberts: Gynecology, 1904.

faulty development of one duct and is associated with deficiency of the corresponding tube and usually the ovary. The kidney and the ureter on the malformed side may also be absent. There may be a rudimentary horn, which is often attached to the cervix by a blind end. The corresponding tube and ovary may be normal.

Absent Uterus.—This is an extremely rare condition and is usually associated with absence of the entire genital system.

Rudimentary Uterus.—The organ is represented by a transverse band of fibro-muscular tissue. The ovaries are usually very small. In a case of rudimentary



FIG. 61.—UTERUS BICORNIS ARCUATUS. CARCINOMA OF BOTH OVARIES. (Case of Dr. G. Y. Rusk, N. Y.)

uterus described by Delay, the atrophic, partly cystic, ovaries were found in the inguinal canals, and a trace of the uterus and tubes was found in one sac. The vagina is either absent or rudimentary. It may exist as a small cul-de-sac, which communicates with the urethral orifice.

Hypoplasia of the uterus results from faulty development occurring in the latter half of pregnancy or in early extrauterine life. Two forms are recognized: the fetal uterus, which consists of a very small body with a long cervix; and the infantile uterus, which is small but presents the normal proportions. Hypoplasia is an occasional sequela of hyperinvolution.

Hypertrophy of the cervix may be due to congenital or acquired conditions. A marked elongation of the cervix is occasionally found in children and young unmarried women, and is frequently associated with slight prolapse of the vaginal walls. Acquired cervical hypertrophy is usually due to severe lacerations and chronic in-



FIG. 62.—UTERUS BICEPTUS, WITH VAGINA DUPLEX. TUBERCULOSIS OF BOTH TUBES AND THE PERITONEUM. (Case of Dr. G. Y. Rusk, N.Y.)

flammation of the tissue, or is associated with prolapse of the vaginal walls, which, according to Winter,¹ induces the cervical hypertrophy by its constant traction.

¹ Winter, G.: "Zur Pathologie des Prolapses," Fest. f. C. Ruge, 1896, p. 22.

Malposition.—The normal position of the uterus is maintained by the tone and contractility of its ligaments, the tone of the pelvic diaphragm, and intraabdominal pressure. Imperfect development, loss of tone, or mechanical interference with the function of these structures, results in displacements of the uterus. Malpositions may be congenital or acquired. They include displacements of the uterus as a whole, with versions and rotations, and displacements involving a change in the relation between the cervix and body of the uterus, comprising flexions, torsions, and inversion.

Displacements of the uterus are usually accompanied by circulatory disturbances, producing edema and congestion and consequent hypertrophy. The endometrium is often hypertrophied and edematous and unusually vascular.

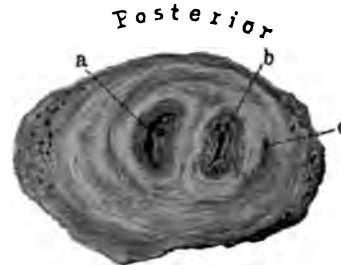


FIG. 63.—CROSS-SECTION THROUGH THE CERVIX SHOWN IN FIG. 62.

INJURIES.

Cervix.—Injury and laceration of the cervix, with few exceptions, occur during parturition, the most extensive injuries arising, as a rule, during instrumental delivery.

A slight unilateral or bilateral laceration, appearing as a small transverse slit, is a common occurrence in normal delivery and has little significance. Deep lacerations may occur on one or both sides, and sometimes also through the anterior or posterior lip (stellate laceration). While they usually occur in the vertical direction, in some instances transverse tears are found. They are almost without exception in the anterior lip, and are due to the prolonged compression of the cervix between the symphysis and the fetal head and the subsequent necrosis of the tissue. Extensive lacerations are followed by the formation of abundant cicatricial tissue, accompanied with more or less infiltration and hypertrophy of the cervix.



FIG. 64.—EVERSION AND HYPEREMIA OF THE CERVICAL MUCOSA, SO-CALLED GRANULAR EROSION. (After Sampson.)

Ectropion.—Infiltration of the muscle and swelling of the mucosa, especially following bilateral laceration of the cervix, are frequently accompanied by separation of the anterior and posterior lips and an eversion or ectropion of the mucosa.

Rupture of the body of the uterus occurs during parturition when there is

some mechanical obstruction to the descent of the fetus, or spontaneous rupture may occur during pregnancy, when the uterine walls are less resistant than normal as a result of disease or antecedent operation, such as Cesarean section, myomectomy, curetage for retained placenta, or when there is a faulty development of the normal elastic tissue of the uterine walls (Williams). The uterine walls may also be injured or perforated by instruments. Perforation of the fundus with a sound or curet is a comparatively frequent accident and is especially liable to happen when the uterine walls are softened and friable as a result of inflammation or after abortion.

The rupture may be complete or incomplete. A complete rupture or perforation of the uterus may open into the peritoneal cavity, into the broad ligament, or, if the lower segment is affected, the perforation may involve the bladder or ureters. The rupture may extend in any direction and is sometimes large enough to permit the escape of the fetus into the abdominal cavity. The injury is usually attended with severe hemorrhage, but in some cases of spontaneous rupture during pregnancy the hemorrhage is so slight as to pass unobserved and the accident is discovered only when operative procedures become necessary for removal of the fetus.

Incomplete rupture is most common in the lower segment and is usually due to pressure necrosis of the tissues occurring during parturition.

DISEASES OF THE ENDOMETRIUM.

It has been the custom to describe almost all benign affections of the endometrium as varieties of inflammatory disease, but although an inflammatory basis, due to bacterial, chemical, mechanical, or toxic influences, may underlie some of these changes, they appear, as a rule, to be purely trophic, and it will simplify our understanding of the pathologic process if such conditions are distinguished from endometritis.

Edema of the endometrium occurs under many conditions which influence the circulation in the uterus, and is most frequently found in cases of slight descensus or in retrodisplacement of the uterus, and also in cases of myomatous uterus. The endometrium appears uniformly thickened, softened, and unusually translucent. The surface is smooth and glistening.

Histologically, in the majority of cases the edema of the mucous membrane is associated with glandular hypertrophy and dilatation; but in some cases the edematous infiltration of the stroma is the only apparent change. The surface epithelium is intact and normal. The glands are also practically unaltered, but in the superficial portion of the mucosa they are widely separated on account of the swelling of the stroma. The stroma exhibits a loose meshwork consisting of a delicate reticulum infiltrated with a serous exudate. The stroma cells are widely separated and appear hydropic. The delicate-walled veins are slightly dilated.

Lymphangiectasis of the endometrium is an unusual condition characterized by a great dilatation of the lymph spaces. I have seen one specimen in which

the entire stroma was honeycombed with the dilated spaces. There was no other pathologic condition discovered.

Gland hypertrophy (erroneously called *glandular endometritis*) is one of the most frequent pathologic conditions met with in the endometrium, and is often found in unmarried women with no history of infection. It is especially frequent in cases of displacement of the uterus and in association with myomata. It is characterized



FIG. 65.—GLANDULAR HYPERTROPHY OF THE ENDOMETRIUM. (75 diameters.)

The surface is undulating or wavy and covered with normal epithelium. The glands show various degrees of hypertrophy and dilation. On the left side sections of a moderately hypertrophied corkscrew gland are seen (a). In the next gland (b) beginning hypertrophy is indicated by the slightly wavy epithelium. At (c) and (d) the characteristic picture of marked hypertrophy is typically represented. The proliferating epithelium is inverted into the dilated lumen in the form of little papillary folds, always accompanied by a delicate stem of stroma. A large thin-walled blood-vessel is seen at (e). (After T. S. Cullen.)

by a general thickening of the mucous membrane, which varies from 5 or 6 to 8 or 10 mm. in thickness. The surface is smooth, slightly undulating or wavy, usually pale, but often mottled with small hemorrhagic areas.

Histologically, the surface outline of the mucosa is slightly wavy, the epithelium intact, but the cells are somewhat swollen and stain lightly. The condition is

chiefly characterized by the change in the glands, which resembles the gland changes in the early decidua. The glands are considerably enlarged and have a characteristic wavy outline. The lumen is two or three times greater than normal, but instead of having a uniform caliber it presents alternate dilatations and narrow portions produced by the inversion of the hyperplastic epithelium. On cross-section the gland has a scalloped or roset-like appearance. The epithelial cells are swollen, slightly granular, and stain lightly. The hypertrophy is not always uniform throughout the endometrium, some portions being almost normal while other portions show marked changes. Generally, the greatest hypertrophy is found in the deep portions of the endometrium, and the stroma is scanty there on account of the compression by the enlarged glands. In the superficial portions it

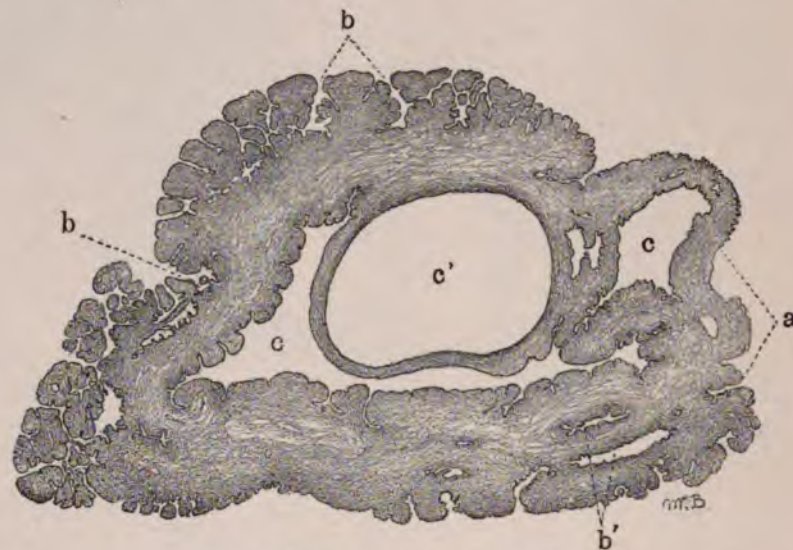


FIG. 66.—MUCOUS POLYP FROM THE CERVIX.

A section of the polyp showing the small area of attachment (a) and the uneven, papillomatous free surface (b) and the numerous superficial glands (b'). The center of the polyp is occupied by two or three large glands (c), one of which (c') is greatly dilated. (After T. S. Cullen.)

is abundant and consists of swollen, lightly stained cells, which bear some resemblance to decidual cells. Occasionally a few lymphocytes are seen between the stroma cells, but as a rule there is no evidence of an inflammatory process. The blood-vessels are slightly dilated.

Mucous polypi, or circumscribed hypertrophies of the mucous membrane, are found in the portio vaginalis, the cervical canal, and the body of the uterus, their structure varying according to the tissue from which they originate. They may be sessile, broad-based, or pedunculate. They appear as bright red, smooth, tongue-shaped, conoid, or pear-shaped outgrowths of mucous membrane. The pedunculate tongue-like processes are very characteristic of the cervical polypi. The pedicle is usually fibrous and tough and sometimes contains one or more rather

large blood-vessels which may bleed freely when the growth is excised. The tissue is generally hemorrhagic.

Histologically, the growth is made up of the glands and stroma characteristic of the part and has a smooth surface covered with the normal epithelium of the part. When the polyp projects beyond the external os and is exposed to injury, there is usually more or less abrasion and superficial inflammation. The glands are often dilated or hypertrophied and the epithelium flattened. The center and base of the polyp are more fibrous than the periphery and may contain smooth muscle bundles. The vascularity is abundant and interstitial hemorrhage is often noticed.

The polypi may be described as extrusions of normal mucosa, but the etiology is obscure. They are found associated with myomata, and with general hypertrophy of the endometrium. They are also met with in young women, not accom-

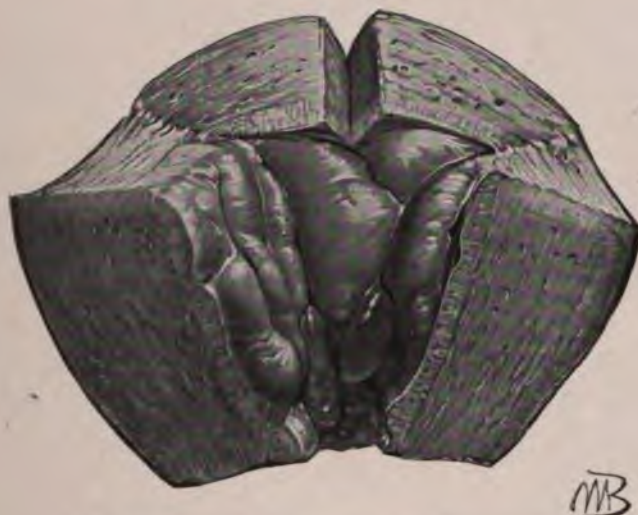


FIG. 67.—POLYPOID THICKENING OF THE ENDOMETRIUM.

The mucous membrane is considerably thickened and is gathered up into smooth, rounded, longitudinal folds. (After Cullen.)

panied by any other abnormality of the uterus and where there is neither evidence nor history of a preceding inflammatory condition.

Polypoid Thickening of the Endometrium Associated with Gland Dilatation, Hyperplasia of the Stroma, and Vascular Changes.—This is one of the most characteristic pathologic conditions of the mucosa and one which possesses great clinical interest, but its etiology and pathogenesis are imperfectly understood. It is especially frequent at the beginning of puberty and at the climacteric, and is clinically characterized by severe hemorrhages. The mucosa is irregularly thickened, forming polyp-like elevations, and is intensely hyperemic. The tissue removed by the curet consists of rather large pieces which at first sight may suggest a new growth, but may be distinguished by the smooth glistening surface,

uniformly translucent appearance, and frequently by the presence of a large number of dilated glands.

Histologically.—As the examination of scrapings is the most important feature of this condition, the microscopic appearance will be considered in relation to them. The fragments of tissue in the section are unusually large, have an undulating, irregular surface, and are covered with slightly flattened epithelium. The glands vary greatly in size, some being perfectly normal, others forming cysts 1 mm. or more in diameter. They are not increased in number, are regularly distrib-



FIG. 68.—DILATED VEINS IN THE ENDOMETRIUM.

The surface epithelium (a) is flattened. The glands are slightly dilated and the stroma somewhat dense. The greater part of the section is made up of ectatic veins (b). (After T. S. Cullen.)

uted, and apart from the dilatation are normal. The epithelium may be flattened in the dilated glands, but is sometimes higher than normal. The most characteristic changes are found in the stroma, which is very cellular and abundant, consisting of closely packed, small, oval or round nuclei with scarcely visible cell body and very little intercellular substance. The nuclei are oval, uniform in appearance, and are frequently seen undergoing indirect division. The blood-vessels are very conspicuous, and here and there large sinuses are seen resembling those found in the decidua of pregnancy (Fig. 68). These are sometimes partially plugged with fibrinous thrombi which may show beginning organization.

The hemorrhage frequently recurs a few months after the curetage, and repeated cureting may be necessary until the menopause occurs. In young individuals frequent curetage may result in a permanent cure, but in some instances the hemorrhage is so persistent and excessive that a hysterectomy is necessary. The disease is apparently secondary to vascular changes and is considered by Pierra¹ and Dalche² to be a vasomotor disturbance of nervous origin occurring in arthritic subjects.

Vascular changes in the myometrium have also been described, but are little understood. In some instances grave hemorrhage has resulted from the rupture of a dilated ectatic blood-vessel in the uterine wall. In cases of climacteric hemorrhage Barbour³ found sclerosis of the uterine vessels.

ENDOMETRITIS AND METRITIS.

Endometritis is the term used to denote the condition induced by the direct action of bacteria or of their toxic products upon the endometrium. In some infections, especially the gonorrheal, and some saprophytic infections, the attack may be limited to the mucous membrane, but in most septic infections, and frequently in gonorrhea, there is more or less invasion of the uterine parenchyma. The inflammatory diseases may be divided into two principal groups: (1) Acute endometritis and (2) chronic endometritis. The microorganisms most frequently forming the exciting cause of the disease are streptococcus (septic endometritis) and gonococcus. Other less common organisms are micrococcus, colon bacillus, diphtheria bacillus, typhoid bacillus, and various saprophytic organisms. The tubercle bacillus is also a frequent invader of the uterus.

Cervical Endometritis and Erosion.—Inflammation of the cervix is commonly the result of gonorrheal infection, but also occurs as a result of trauma and infection in cases of descensus of the uterus, especially when there is also a cervical laceration with eversion of the lips. Macroscopically the portio vaginalis is reddened and granular, and is bathed in an abundant mucous or mucopurulent discharge. There are often one or more Nabothian follicles varying in size from a pinhead to a small pea.

Histologically, the surface epithelium is intact, but is more or less infiltrated with round or polymorphonuclear leukocytes. The glands are frequently dilated and filled with mucus or pus. The stroma is infiltrated with small, round cells, plasma cells, and polymorphonuclear leukocytes, and there are many newly formed blood-vessels. The inflammatory process is almost always quite superficial.

Cervical Erosion.—True erosion of the cervix is exceedingly rare and almost the only instances which have come under my observation have been in cases of

¹ Pierra, L. M.: "Congestion Uterine Primitive chez les Arthritiques nerveuses," *La Gynecologie*, 1904, p. 139.

² Dalche, P.: "Un cas de metrorrhage virginale," *La Gynecologie*, 1904, p. 212.

³ Barbour, H. H. F.: "Climacteric Hemorrhage due to Sclerosis of the Uterine Vessels," *Scotland Med. and Surg. Jour.*, June, 1905.

prolapsus where the cervix has been exposed to traumatism. The entire portio vaginalis may be thickened, indurated, and covered with a grayish necrotic membrane; in other cases there is a circumscribed ulceration on one or both cervical lips. The ulcerated surface presents bright red granulations, partly covered with a fibrino-purulent membrane. It is very suggestive of an early carcinoma, but is usually seen to be more superficial and less friable, and shows more necrosis than a carcinoma at an early stage. Often, however, a positive diagnosis can be made only by means of the microscope, when the characteristic inflammatory process associated with loss of epithelial structures is found.

Eversion of the mucous lining of the cervical canal (*granular erosion*, *pseudo-erosion*) is frequently accompanied by a mild chronic inflammatory process, but is not associated with loss of substance as in true erosion.



FIG. 69.—EROSION OF THE VAGINAL PORTION OF THE CERVIX. (75 diameters.)

The section is taken from the edge of the ulcer and on the left merges into the normal mucosa. The squamous epithelium (a) is swollen and infiltrated and is lifted up from the stroma by pus. It gradually disappears at the edge of the ulcer on the left. The surface is covered with fibrin (d) containing polymorphonuclear (e) and small round cells (f) in its meshes. The stroma is densely infiltrated and contains many newly formed capillaries. (After T. S. Cullen.)

Congenital Erosion.—Erosion of the cervix in the newly born is said to be comparatively frequent. The condition usually described, however, is not a true erosion, but resembles the so-called granular erosion or ectropion of the cervical mucosa, and is probably a developmental anomaly in which the squamous epithelium does not extend within the external os.

Acute endometritis is characterized in its early stage by an acute swelling, edema and congestion of the tissue, and the uterus is large, soft, and boggy. The surface of the mucosa becomes finely granular, intensely injected, and hemorrhagic. It is covered with a seropurulent or purulent exudate, and, as a rule, presents areas of superficial necrosis. In some saprophytic infections, especially following criminal abortion, the entire cavity may be lined with a thick necrotic membrane. If

the cervical canal becomes obstructed the purulent secretion is retained in the uterus and a pyometra develops which in some cases forms a tumor as large as a child's head.

Histologically.—Acute endometritis is characterized by edema, leukocytic infiltration, and increased vascularity of the stroma; with swelling, necrosis, and degeneration of the epithelial elements. The epithelial lining is often lacking in places and a typical granulating surface is found. In other places there is proliferation of the epithelium; it becomes convoluted and thickened, and sometimes forms little papillary outgrowths consisting of a stem of vascular, infiltrated stroma, covered



FIG. 70.—ENDOMETRITIS WITH LOCALIZED THICKENING OF THE EPITHELIUM. (130 diameters.)

The whole section shows a decided inflammatory reaction. On each side there is an infiltrated but fairly normal gland. In the middle a small portion of the epithelium is proliferated and forms an irregular wedge with convoluted margin which extends down into the stroma. The cells are swollen and lightly stained, but do not appear to be actively proliferating. (After T. S. Cullen.)

with several layers of epithelium, which is also densely infiltrated with leukocytes. The epithelial cells at these points are swollen and lightly stained, containing large, pale, vesicular nuclei. They sometimes surround little gland-like or cystic spaces (Fig. 70). There is no indication of rapid growth, the cells, on the contrary, appearing slightly degenerate. The uterine glands in some places, especially near the surface, appear to be compressed by the infiltrated stroma, while in other places they may be dilated and filled with polymorphonuclear leukocytes and desquamated epithelium. The gland epithelium is swollen and stains poorly.

Kubassow¹ described a condition, which he designated endometritis dis-

¹ Kubassow: "Endometritis Dissecans," *Zeit. f. Geb. u. Gyn.*, 1883, Bd. ix, S. 310.

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secans, in which the uterine mucosa, generally accompanied by some muscle bundles, is cast off. The disease follows an acute, general or local, infection, and is differentiated from membranous dysmenorrhea by the absence of recurrence.

Chronic Endometritis.—A persistent chronic inflammation of the endometrium is comparatively infrequent, probably on account of the good drainage of the cavity, and the abundant blood-supply of the mucous membrane. Unless there is a constant infection from a pyosalpinx, or unless fragments of secundines have been retained, the inflammatory process in the uterus soon subsides. Chronic inflammation of the endometrium is usually due to the gonococcus. Macroscopically, the mucosa is usually thickened and uneven and may be beset with wart-

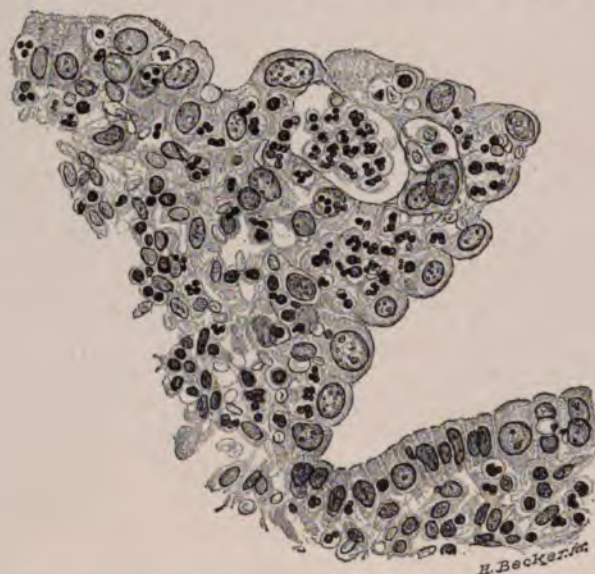


FIG. 71.—PROLIFERATION OF THE SURFACE EPITHELIUM IN ACUTE ENDOMETRITIS. (380 diameters.)

The epithelium generally is swollen and infiltrated and near the center of the section is heaped up so as to form a pyramidal outgrowth. A large vacuole in the midst of the proliferated epithelium is filled with polymorphonuclear leukocytes, which are also found between and within the epithelial cells. (After Cullen.)

like papillary elevations; it may present a general polypoid condition. The tissue is injected, often mottled with subepithelial hemorrhages, and may show slight abrasions. An atrophic condition of the endometrium may follow the subsidence of the active inflammation.

Histologically.—The most pronounced changes are found in the superficial portions of the endometrium, and consist of a dense round-cell infiltration and increased vascularity of the stroma, and proliferation of connective-tissue cells. The surface epithelium is flattened, and desquamated in places. The glands are often separated by the hyperplastic stroma; in the deeper portion of the mucosa they are often dilated and hypertrophied. Localized thickenings of both the surface and glandular epithelium resembling squamous epithelium are occa-

sionally seen in chronic inflammation (Fig. 72). This condition is possibly analogous to leukokeratosis of the vulvar mucosa.

Membranous dysmenorrhea (*exfoliative endometritis*) is a term applied to a condition in which considerable portions of the endometrium are cast off repeatedly at the menstrual period. The affection is not a pathologic entity, but a condition which develops under varying circumstances, complicates different pathologic processes, and presents a variety of different microscopic appearances. The disease was first recognized by Morgagni, but until Wyder, in 1878, gave a clear description

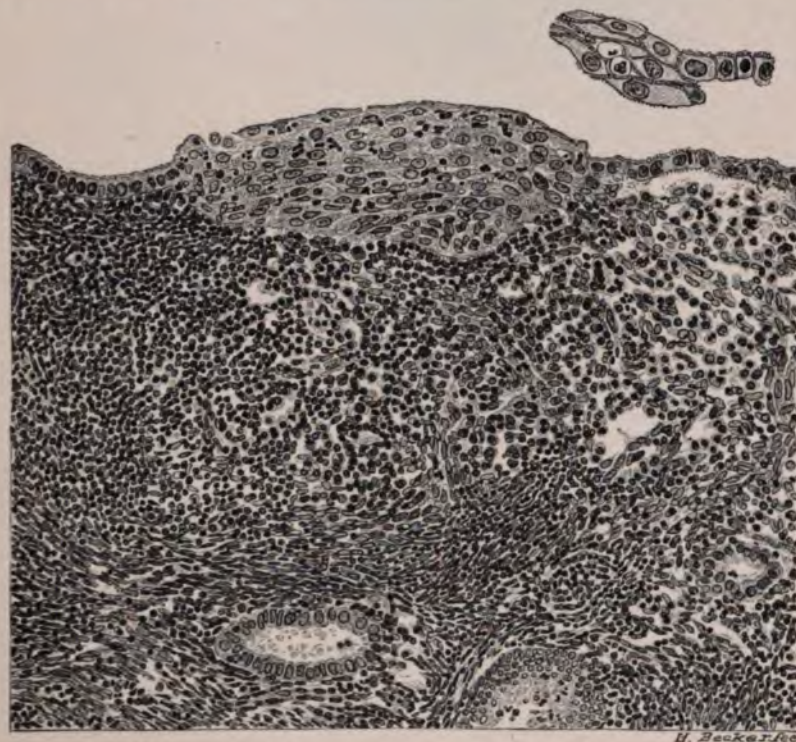


FIG. 72.—CHRONIC ENDOMETRITIS ASSOCIATED WITH A LOCALIZED THICKENING OF THE EPITHELIUM SIMULATING SQUAMOUS EPITHELIUM. (X 165.)

The whole section shows an active chronic inflammatory process. The thickened portion of the epithelium ends abruptly on each side in the normal epithelium. The proliferating cells resemble squamous epithelium, and, as shown in the small sketch, are joined by definite intercellular bridges. (After T. S. Cullen.)

of the histologic appearances, it was not clearly differentiated from the decidual membranes thrown off in early abortions or in extrauterine pregnancy (Morse¹). The most important etiologic factor is an antecedent endometritis. A considerable number of cases occur in young unmarried women with no history of infection, but there is here the possibility of an infantile vaginitis or an endometritis accompanying the exanthemata. The membrane, when discharged entire, forms a triangular sac having the shape of the uterine cavity and sometimes showing the

¹ Morse, E.: "Membranous Dysmenorrhea," to appear in Johns Hopkins Hospital Bulletin.

openings corresponding to the tubes and cervix. The outer surface is shaggy, the inner smooth. It may be as thin as tissue paper or 2 or 3 mm. thick. Usually the membrane is passed in fragments. Microscopically, two forms of casts are found,—exfoliated mucosa and fibrinous casts. The exfoliated mucosa may show simply a chronic inflammation accompanied by an infiltration of fibrin and blood in the stroma, or it may be characterized by a change in the appearance of the stroma cells which bear a striking resemblance to decidua cells. The two pictures are often combined in the same specimen. Glands are often present. A “budding” of the interglandular tissue, or compact foci of stroma cells in which growth is more active, has been described by von Franqué,¹ but is also present in other conditions. Degenerative changes similar to those found in the decidua in the latter half of pregnancy are usually present.

Fibrinous casts consist of a network of fibrin, containing in its meshes red blood-cells, leukocytes, and cells from the endometrium. They develop under the same conditions as the organized membranes, and the same patient may pass one variety at one menstrual period and the other at the following period. The menstrual membrane may be simulated by a vaginal cast, which is thrown off during menstruation or independently of it, or by a decidual cast. The vaginal membrane is usually thinner, tougher, and more parchment-like, while the decidual membrane is thicker and more vascular. The histologic pictures are distinctive, the vaginal cast consisting of squamous epithelium, while the decidual cast presents the characteristic cells.

Tuberculosis of the Uterus.—Tuberculous endometritis is a much more common affection than is usually supposed, but is rarely primary. The majority of cases of tubercular salpingitis are accompanied by tuberculosis of the endometrium, although the disease is often limited to the vicinity of the cornua. The disease is most frequent in the body of the uterus and seldom attacks the cervix. It appears in two forms: (1) Miliary, and (2) ulcerative, or caseous. In the former the endometrium is studded with miliary tubercles, but the surface is smooth or slightly granular and the epithelium mostly intact. In the ulcerative form, the entire cavity, or a large portion of it, is lined with typical grayish-yellow gelatinous tuberculous granulations covered with soft grayish-yellow caseous material. The glands and stroma in the depth may be practically normal; often, however, the mucosa is entirely destroyed by the tuberculous process. If the internal os becomes stenosed the body is distended with thick, creamy pus. In advanced cases the muscular walls of the uterus are usually infiltrated with miliary tubercles.

Tuberculosis of the cervix usually appears as a caseous ulcerative process, but in some cases forms a hyperplastic vegetative outgrowth which resembles a venereal wart or an early papillary carcinoma. Histologically, the characteristic lesions of tuberculosis are easily detected, consisting either of typical miliary tubercles or of a more diffuse proliferation of epithelioid and small round cells.

¹ v. Franqué, O.: “Beitrag zur pathologischen Anatomie der Endometritis Exfoliativa,” Zeit. f. Geb. u. Gyn., Bd. xxvii, S. 1.

Retained Membranes (*Subinvolution of the Uterus*).—In many cases there is persistent bleeding after childbirth or abortion, and upon examination the uterus is found to be slightly enlarged. On curetage a considerable amount of material



FIG. 73.—TUBERCULOSIS OF THE CERVIX. ($\times 180$.)

The section, which is taken from a scraping, shows the normal high cylindric epithelium at (a) and (b), and a section of the base of a gland at (e). The stroma is everywhere infiltrated with tubercle tissue consisting of masses of epithelioid cells (g, g', g'', g''') and areas of dense round-cell infiltration (h). At (f) a typical tubercle is seen, consisting of a round clump of epithelioid cells surrounded by small round cells and containing a central giant cell (f). The nuclei of the giant cell have the characteristic mural arrangement. (After T. S. Cullen.)

is removed, but often it is only a little more than normal. Histologically, the endometrium presents a varied picture. Some parts may appear perfectly normal, while others show a more or less pronounced chronic inflammatory process. The

chief feature noticed is the presence of islands of decidual cells and canalized fibrin in the stroma of the mucosa. The persistence of the decidual cells is probably dependent upon an old endometritis, which would also explain the almost constant association of retained fetal membranes. The decidual nests may consist of clumps of well-formed decidual cells, but more often, especially if some time has elapsed since the pregnancy, only two or three cells may be seen in a considerable area of hyaline material. Decidual cells may also be seen in the hyaline walls of obliterated blood-vessels. The mucosa in the vicinity of the decidual areas is usually the seat of a chronic inflammation.

DISEASES OF THE DECIDUA.

Decidual endometritis may be divided into acute and chronic forms. Acute inflammation of the decidua may be due to the extension of a preëxisting endometritis or may be caused by acute general infections, especially the acute exanthemata, developing during pregnancy. Bacteriologic examinations are usually negative. The gonococcus, some bacilli and cocci have been described. The disease is characterized by swelling and infiltration of the decidua, and in some cases by severe hemorrhagic degeneration, or by suppuration. Acute hemorrhagic inflammation of the decidua was observed by Slavjansky¹ in two cases associated with cholera, and it is probable, as Edgar suggests, that a similar condition may develop in the presence of the acute exanthemata. Purulent deciduitis was described in one case by Donat.² The placenta, which was expelled at term, was surrounded by a layer of decidual tissue infiltrated with pus. Pus was also found between the amnion and chorion. The condition was probably the result of attempted abortion. A mild grade of purulent endometritis gravidarum has also been observed by J. Whitridge Williams.³ Gangrene of the whole inner portion of the uterine wall following delivery has been described by Schmidlechner.⁴

Chronic endometritis of pregnancy is characterized by a diffuse or localized round-cell infiltration and connective-tissue proliferation, usually accompanied by more or less marked vascular changes. It is usually due to the persistence of an antecedent acute or chronic infection which was not severe enough to prevent the pregnancy. The importance of the acute and chronic endometritides of pregnancy is due to their influence in causing abortions and to the frequent adherence of the placenta after delivery.

Atrophy of the decidua is probably the result of a chronic inflammatory process, or may be a purely atrophic change.

Other rare diseases of the decidua which are usually classified as inflammatory appear to depend upon trophic disturbances and are analogous to the conditions of similar origin in the non-pregnant uterus. They include excessive gland hypertrophy, general diffuse hypertrophy, and polypoid thickening. The etiology and

¹ Cited from Edgar: Obstetrics.

² Cited from Edgar: Obstetrics.

³ Williams, J. W.: Obstetrics.

⁴ Arch. f. Gyn., 1906, Bd. lxxviii, S. 525.

pathogenesis of these conditions are not clearly understood. They are believed to be causal factors in the production of abortion, probably causing the death of the fetus by interfering with its nutrition.

Gland hypertrophy (*hydrorrhea gravidarum*) of the decidua is characterized by dilatation and hypertrophy of the glandular elements accompanied by an excessive watery secretion.

Diffuse Hypertrophy (*Endometritis Deciduae Hypertrophica*).—Instead of a thinning of the decidua during the later months of pregnancy, it may remain as thick as it was in the early months or even become thicker. The hypertrophy affects both the compact and the spongy layer and is accompanied by dilatation of the blood-vessels.

Polypoid thickening of the decidua (*deciduitis polyposa*) consists of a diffuse hyperplastic condition of the decidua associated with more marked localized thickening, forming polypoid outgrowths.

NEOPLASMS OF THE UTERUS.

Tumors of the uterus may originate from the epithelial elements of the mucosa, from the stroma of the mucosa, or from the fibromuscular parenchymatous portion of the organ. They include carcinoma, myoma, adenomyoma, sarcoma, and mixed tumors. Chorioepithelioma, as it originates within the uterus, is also included in the group of primary uterine tumors.

Carcinoma.—*General Considerations.*—By carcinoma of the uterus is understood a malignant growth the essential elements of which consist of cells more or less definitely epithelial in character and having a characteristic alveolar arrangement. The malignancy of the tumor is shown anatomically by its autonomy in relation to the general organism. The cancer-cells have unlimited power of proliferation and invade the surrounding healthy tissue. They have, furthermore, the faculty of proliferating after being transplanted from the parent tissue to another site,—i. e., to form metastases. The epithelial nature of the cells is shown by their relatively large size and the single, well-stained vesicular nucleus with one or more distinct nucleoli. The protoplasm is usually plainly visible. There is no intercellular substance, but prickles or cell bridges are usually discernible.

According to the variety of epithelium from which they arise, carcinomata may be divided into two groups: (1) Those arising from squamous epithelium—squamous-cell carcinoma; (2) those arising from cylindric epithelium—cylindric-cell carcinoma or adenocarcinoma. The epithelial elements which form the essential part of the new growth appear as cell-strands, branching processes, and nests, surrounded by the tissue of the part which makes the stroma of the tumor. The epithelial processes may consist of solid masses of cells which invade the underlying tissue or may form closely packed groups of tortuous, branching, anastomosing glands having more or less definite lumina lined with one or several layers of epithelium. Solid cell-cords and nests are usually derived from squamous

epithelium, but may also occur in cylindric-celled tumors. In uterine carcinoma, however, the cylindric-celled growths usually show a definite glandular structure.

The proliferating epithelium in both the squamous and cylindric-celled tumors not only invades the underlying tissue but also gives rise to papillary or polypoid outgrowths on the surface of the endometrium or vaginal portion of the cervix. These begin as little epithelial projections which are soon provided with a delicate stem of vascularized stroma that pushes up into the epithelial mass.

The gross anatomy of uterine carcinoma is thus easily understood. Superficially, there is a vascular, friable, papillary growth, and on section of the deeper tissues strands of fibrous tissue form irregular alveoli containing a granular, homogeneous, grayish mass; or, if the cancer-nest has been extruded, the alveolus may be empty. In some tumors the epithelial overgrowth is so great that large masses of epithelium are only imperfectly divided into alveoli by the scanty stroma, the so-called medullary carcinoma. This variety of tumor is usually circumscribed. In other cases there is an excessive growth of stroma and the epithelial processes are long and narrow, so-called scirrhus of the uterus. In this form of growth there is no evidence of a tendency to remain circumscribed and the tissues are diffusely infiltrated in all directions.

Histologically, carcinoma is characterized not only by the irregular proliferation of the epithelium, but also by a characteristic alteration in the type of the individual cells. In some varieties of tumors, even in an advanced stage, the epithelial cells conform more or less closely to the type of the parent cell; in other instances marked variations from the type are found even in the early growth. In the former case the tumors often appear to be less actively malignant than in the latter. Apparently, as Gebhard says, as the cells lose in differentiation they gain in power of independent existence. The variation in biologic condition (anaplasia of Hanse-mann) is apparently most marked in cylindric-celled tumors. Metaplasia is described as being frequently exhibited in cylindric-celled growths, but its occurrence is questionable. Mitotic figures are very numerous in carcinomata and may present many atypical forms. Asymmetric division is one of the most common features; multipolar mitosis, hyperchromatosis, and karyorrhexis are also frequently observed. The occurrence of the special form of mitosis in malignant tumors, which has recently been described by Farmer, Moore,¹ and others, requires further confirmation.

Degenerations are noticed in the older portions of the growth, particularly in tumors where there is an excessive epithelial proliferation and scanty blood-supply. It is, therefore, in the so-called medullary type of growth that degeneration is most marked, the center of cell-nests showing the most striking changes. The principal degenerations are coagulation necrosis, hyaline and fatty changes, vacuolization, and

¹ Farmer, J. B., Moore, J. E. S., and Walker, E.: "On the Resemblances Exhibited between the Cells of Malignant Growths in Man and Those of Normal Reproductive Tissues," *Proc. Royal Soc. London*, 1903, vol. lxxii, p. 499.

nuclear fragmentation. Cell inclusions, consisting of leukocytes, other epithelial cells, hyaline droplets, etc., are also common.

The confusion of the cell inclusions and degenerations with cancer parasites cannot be fully discussed in this work and the reader is referred to the numerous special articles dealing with this subject.

Examination of Curetings.—The diagnosis of uterine cancer by means of the microscopic examination of curetings from the cervical canal and cavity of the body, or the examination of small fragments excised from the portio



FIG. 74.—SQUAMOUS-CELL CARCINOMA OF THE VAGINAL PORTION OF THE CERVIX.

The new growth consists of a typical cauliflower mass attached to a well-defined circumscribed portion of the anterior cervical lip. (After Cullen.)

vaginalis, is now generally recognized as one of the most important means of clinical diagnosis. The gross appearance of the curetings is often suggestive, as instead of the normal thin, smooth, translucent strips of mucosa, they consist of irregular, shaggy, friable, often granular or waxy-looking fragments of tissue, which may be of large size. The amount, unless very excessive, is not of great significance, as in simple hyperplastic conditions, retained secundines, etc., a large amount of tissue may be removed. It is often impossible from either the macroscopic or microscopic examination of scrapings to determine the invasiveness of the tumor,

but in the majority of cases the diagnosis offers no special difficulties to the skilled pathologist, as the characteristic alveolar growth associated with the evidence of rapid cell division and the atypical character of the cells usually found make up a characteristic picture. In some cases, however, where only very small superficial fragments are available, it is impossible to make out the pattern of the growth, and the diagnosis depends almost wholly upon the atypical character of the individual cells; while again in some varieties of adenocarcinoma the type of the glands and of the individual cells is so little altered that the diagnosis is exceedingly difficult. It is very exceptional, however, that some area of pathognomonic significance is not found.

Preparation of Curetings.—The examination of curetings is greatly facilitated if the specimen is carefully prepared,



FIG. 75.—SQUAMOUS-CELL CARCINOMA OF THE CERVIX. Infiltrating form, with necrosis producing an apparent second external os. (After J. Sampson.)

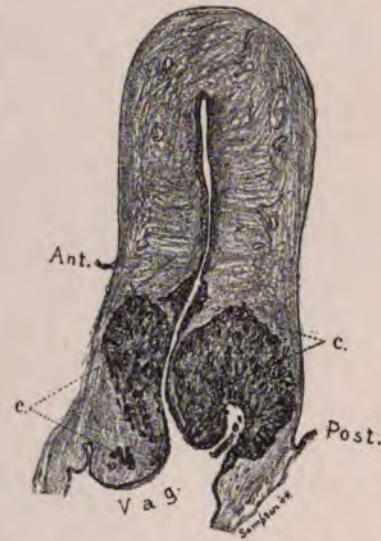


FIG. 76.—SAGITTAL SECTION OF THE UTERUS. SAME CASE AS FIG. 75.

The disease has apparently started in the posterior cervical lip and by direct extension has invaded the deeper tissues of the cervix, surrounding the canal and in places infiltrating the mucosa.

whereas, if the fragments become shrunken and the cells distorted, a diagnosis is often impossible. A simple and satisfactory method of preparation is as follows:

Immerse in formalin, 10% solution	12-24 hours.
“ “ alcohol, 95%	12 “
“ “ absolute alcohol	12 “
“ “ alcohol and ether	12 “
“ “ celloidin	12 “

Block and cut, and stain with hematoxylin and eosin.

The curetings should be dropped immediately into the bottle containing the formalin solution, without previous washing. If a speedier method is desirable the time for leaving in the various solutions may be shortened. If it is desired to make an immediate diagnosis so as to avoid a second anesthetization, frozen sections may be prepared in the following manner:

The tissue is frozen with ether or carbon dioxide, sections made and dropped immediately into 10 per cent. formalin solution, transferred to 80 per cent. alcohol, washed, and stained with hematoxylin and eosin in the usual way. With this method a diagnosis can be made in from ten to fifteen minutes, about the time necessary to prepare the patient for abdominal section in case a radical operation should be necessary.

In making the microscopic examination of curetings every portion should be carefully observed—the surface outline, the character of the surface epithelium, the size, shape, number, and distribution of the glands, the character of the gland epithelium, the relative amount and character of the stroma, and any evidence of inflammatory reaction noted.

A common error in interpreting the microscopic picture in the case of curetings is to mistake the apparent thickening of the epithelium, which is due to oblique

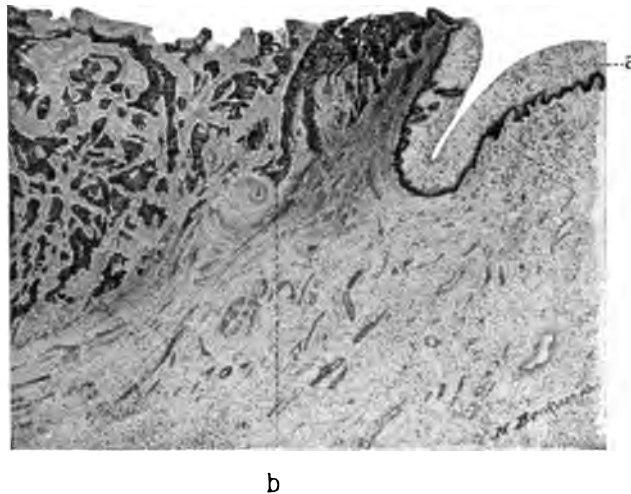


FIG. 77.—SQUAMOUS-CELL CARCINOMA OF THE CERVIX. SHOWING THE POINT OF JUNCTION OF THE NORMAL SQUAMOUS EPITHELIUM (a) WITH THE ALTERED EPITHELIUM OF THE NEW GROWTH (b). (After H. A. Kelly.)

sectioning, for a true increase in the number of layers. A little practice enables one to readily distinguish between these conditions. A guide to their recognition is clearly illustrated by Gebhard, who shows that in a horizontal section through the epithelium the hexagonal outline of the prismatic cell is well defined, and according to the plane of the section each or none of the cells may have a nucleus in the center. In oblique sections the cells still appear hexagonal, but all of the nuclei appear in one zone, the largest in the center. When the epithelium is thickened, on the other hand, the cells are often not regularly prismatic, and large and small cells and nuclei are intermingled. Cross-sections of convoluted and branched glands may present a complicated appearance, somewhat suggestive of atypical proliferation, but the normal character of the epithelium and the regular disposition of the glands speak against any malignant tendency.

Carcinoma of the uterus may be classified, according to its location, as carcinoma of the body and carcinoma of the cervix.

Carcinoma of the Cervix.—Carcinoma of the cervix may be divided into two groups,—those arising from the vaginal portion, and those arising within the canal. These may again be subdivided into squamous- and cylindric-cell carcinoma.

Squamous-cell carcinoma of the cervix is not only the most frequent variety of uterine cancer but comprises almost one-third of all forms of primary cancer. Unfortunately, while one of the easiest to diagnose in the very earliest stages, in many cases it develops so insidiously, with slight or no clinical mani-



FIG. 78.—SQUAMOUS-CELL CARCINOMA OF THE VAGINAL PORTION OF THE CERVIX.

The section shows the transition from the normal into carcinomatous epithelium. The normal epithelium is seen at (a) with cross-sections of two papillae (b). At (c) the normal merges into the carcinomatous epithelium, which is stained more deeply on account of the crowding together of the cells and the relatively large size and deep stain of the nuclei. Very large hyperchromatic nuclei are seen at (d) and (g). The stroma immediately beneath the growth (i) and forming the lengthened papilla (e) is densely infiltrated with small round cells. (After T. S. Cullen.)

festations, that when the patient is first seen an extensive invasion of the tissue has occurred.

The tumor presents two definite morphologic types: (a) the vegetative, cauliflower, or papillary growth; (b) the nodular or infiltrating growth.

In the earliest stages there is usually seen a more or less sharply circumscribed injected area, having a granular surface which to the touch feels slightly infiltrated. As the growth progresses, a pedunculate or sessile papillary mass develops, associated with more or less extensive infiltration of the underlying tissue. In some instances

a large mass, which entirely fills the vault, may be attached by a pedicle not more than 1 cm. in diameter, and there may be no apparent invasion of the deeper structures. The papillary growth may be distinguished from a condyloma by its greater friability, bleeding upon slight manipulation, and the finer, thread-like papillæ. In the earliest stage the small vascular vegetative outgrowth may be simulated by tuberculous or syphilitic lesions, and the diagnosis can then be made only by means of a microscopic examination or from the clinical history of syphilitic or tuberculous infection.

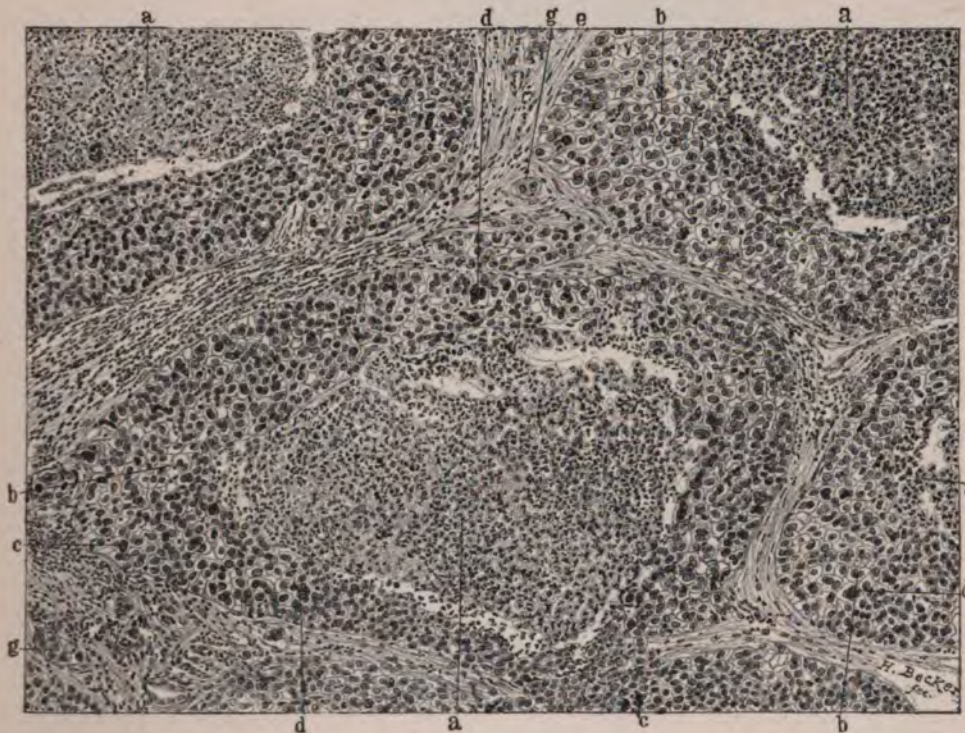


FIG. 79.—SQUAMOUS-CELL CARCINOMA OF THE CERVIX. (100 diameters.)

The tissue, which is from a scraping, consists of very large alveoli surrounded by thin fibrous septa (e). The centers of the alveoli contain a mass of pus and cellular detritus (a) which may have partly trickled down from the surface. The epithelial cells are many layers thick and are of the squamous type (b), but show many atypical forms (c, d). Isolated epithelial cells are occasionally found in the stroma (g). (After T. S. Cullen.)

The infiltrating form of carcinoma of the vaginal portion of the cervix in the earliest stage is usually characterized by more or less hypertrophy of the cervix, associated with a nodular or more diffuse induration of the invaded portion, while the surface has a somewhat livid, glazed appearance. As the disease progresses, necrosis of the central portion often occurs, producing a deep ulcer with ragged, infiltrated margins. The necrosis and ulceration gradually spread until finally the entire cervix is destroyed and in the vaginal vault a large crater-like cavity is found. In other instances the cervix is shrunken, hard, and surrounded by densely indurated tissue.

According to Gebhard, the form of the neoplasm depends upon the vascularity of the tissue. If the blood-supply is abundant, the vascular papillæ accompany the epithelial growth and a superficial tumor develops, whereas, with a poor blood-supply, the surface lacks nourishment and the epithelial proliferation can occur only in a downward direction.

HISTOLOGIC EXAMINATION.—In the examination of squamous-cell carcinoma the most interesting information is obtained from the study of early growths and of the margins of more advanced conditions. The normal stratified epithelium of the vaginal portion is often well preserved to the very edge of the



FIG. 80.—SCIRRHOUS SQUAMOUS-CELL CARCINOMA OF THE CERVIX. (130 diameters.)

The invading epithelial processes are seen in the darker areas, while the dense fibrous stroma is stained more lightly. The growth is characterized by the small narrow epithelial processes seen in longitudinal (a), cross (b), and oblique (c) sections, and the relatively large amount of dense stroma. (After T. S. Cullen.)

neoplasm, and, apart from a round-cell infiltration becoming denser as the tumor is approached, is practically unaltered. At this point there is a sudden change in the character of the epithelium, noticeable under the low power of the microscope or even with the naked eye examination of the sections, on account of the deeper coloration with the nuclear stain. This is due partly to the crowding together of the epithelial cells and in part to the increase in the size and staining properties of the individual nuclei. At the margin of the growth there may be little or no thickening of the epithelium, but a little further on there is a lengthening of the interpapillary processes which invade the

underlying tissues in all directions, sometimes in the form of long, slender, anastomosing cords; again, as large masses which on cross-section appear as round or oval nests. "Cancer pearls" are occasionally seen. Surrounding the epithelial down-growth there is a more or less dense zone of round-cell infiltration; in some cases large numbers of eosinophiles are found. In the case of papillary or villous tumors, the proliferating epithelium not only invades the underlying structures, but also—often, indeed, to a great degree—sprouts from the surface and is accompanied by vascular prolongations of the stroma. In some cases the growth is almost entirely superficial, while in other cases it is chiefly, or entirely, downward. As the epithelial invasion increases the stroma often becomes so scanty in the older parts of the

growth, and the nutrition so greatly diminished, that extensive necrosis occurs, beginning with degenerative changes in the cells in the center of the alveoli, but gradually spreading with the advance of the disease. With a higher magnification the individual epithelial cells show more or less pronounced deviation from the type. In some tumors the cells are fairly uniform in appearance, but generally the cell nuclei vary greatly in size, shape, and staining properties, while the cytoplasm also exhibits various degenerative changes. Nuclear figures are usually abundant and are often atypical.

Cylindric-celled carcinoma of the vaginal portion is infrequent



FIG. 81.—ADENOCARCINOMA OF THE CERVIX.

The growth occupies principally the left half of the anterior and posterior cervical walls, extending to the portio vaginalis below, to the internal os above, and penetrating almost to the parametrium. The homogeneous, dense, white, opaque tumor is sharply contrasted with the normal uterine walls. Its surface is covered with fine villous or papillary projections. (After T. S. Cullen.)

as compared with squamous-celled carcinoma. It may arise from the mucous glands of the cervix or from the surface epithelium in cases where the cylindric epithelium of the cervical canal extends beyond the external os. In its gross appearance the tumor is very similar to a squamous-cell carcinoma. Papillary and polypoid outgrowths are sometimes seen, but as the neoplasm usually originates in glands, there is a greater tendency toward a rapid invasion of underlying structures, and frequently the surface of the vaginal portion is quite smooth or is thinned out over a deep-seated nodular tumor. The presence of the growth is then recognized by the thickening and excessive density of the tissues.

Histologically, the growth is characterized by the atypical proliferation of the cervical glands, exhibited in (1) the atypical grouping, irregular branching, and frequent interanastomosis; (2) the atypical character of the epithelium, *i. e.*, multiplication of cell layers, irregularities of individual cells, abundant mitoses.

Carcinoma originating in the cervical canal is the most fatal form of uterine cancer, owing to the intimate relationship of the blood and lymph vascular supply of the uterus to this portion, as it is virtually the hilus of the organ. The tumor may be of either the squamous- or cylindric-cell variety,—in the cases studied by

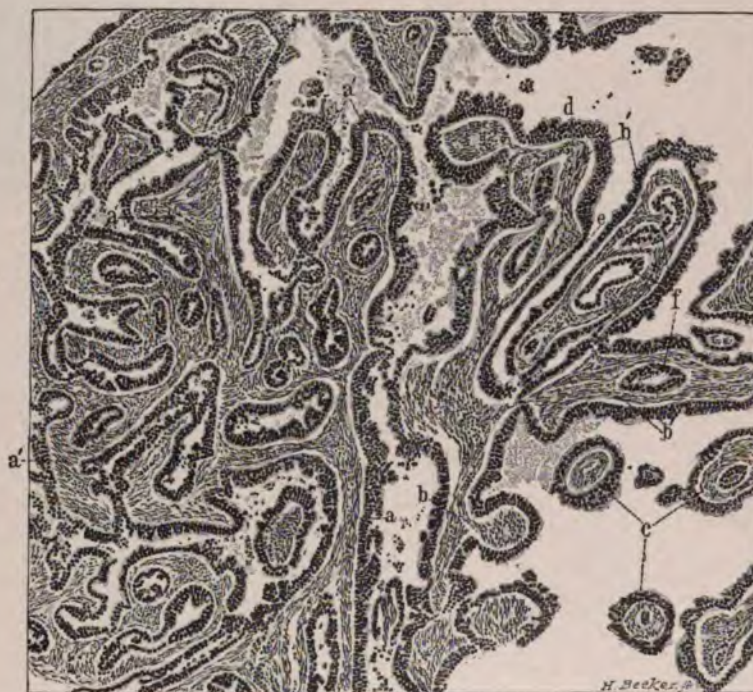


FIG. 82.—ADENOCARCINOMA OF THE CERVIX. (80 diameters.)

The section is from the superficial portion of the tumor and shows the characteristic papillary outgrowths with the main stalks (a and b) and the secondary branches (a', b'), while cross-sections are seen at (c) and the depressions between the folds appear as glandular spaces (f). The papillary outgrowths are covered with from one (e) to several (d) layers of cylindric epithelium. The epithelial cells have small, oval, deeply stained nuclei of fairly uniform appearance. The stroma consists of dense, cellular, fibrous tissue. (After T. S. Cullen.)

Sampson the two forms occurred in almost equal numbers. The diagnosis is more difficult than in carcinoma of the vaginal portion, as the tumor is situated within the canal and on inspection the cervix may appear normal. The important diagnostic signs are: (1) The enlargement of the cervix, which is often nodular; (2) the induration, sometimes associated with extreme friability; and (3) the marked tendency to bleed, even when handled with the utmost care. As the disease advances the surrounding tissues become infiltrated and the cervix is more or less immovable. In the early stages the enlargement and induration are slight and not

unlike the conditions produced by chronic inflammation. The diagnosis then depends upon a microscopic examination of the curetings.

Carcinoma of the body of the uterus is the most favorable of all forms of carcinoma of the reproductive organs. It is relatively slow-growing and on account of the



FIG. 83.—ADENOCARCINOMA OF THE CERVIX. (90 diameters.)

The section shows the early gland changes in carcinoma, characterized chiefly by the unusually complicated and irregular branching of the gland (a) and the formation of new glands. The epithelium in some places is of the usual high cylindric type and a single layer in thickness; in other places the cells are lower and the nuclei relatively large; and again, the epithelium is several layers thick. (After T. S. Cullen.)

anatomic relations of this portion of the uterus, which is almost free in the pelvic cavity, the growth does not invade surrounding structures nor metastasize until late.

The value of the microscopic examination of scrapings is most conspicuous in the diagnosis of pathologic conditions affecting the uterine cavity. In the early

stages it is impossible to determine the presence of cancer of the body by means of a pelvic examination or even from the external appearance of the uterus after removal. The organ is practically unaltered in size, shape, and consistency. As the disease advances the uterus may become large and firm or boggy; or, again, it may be more or less nodular, and, if extension to the peritoneal surface has taken place, irregular, flattened nodules are found there. In other cases it is small and irregular in form but appears to be densely infiltrated. On cutting the uterus open the early growth appears as a localized papillary or villous tumor, or there is a

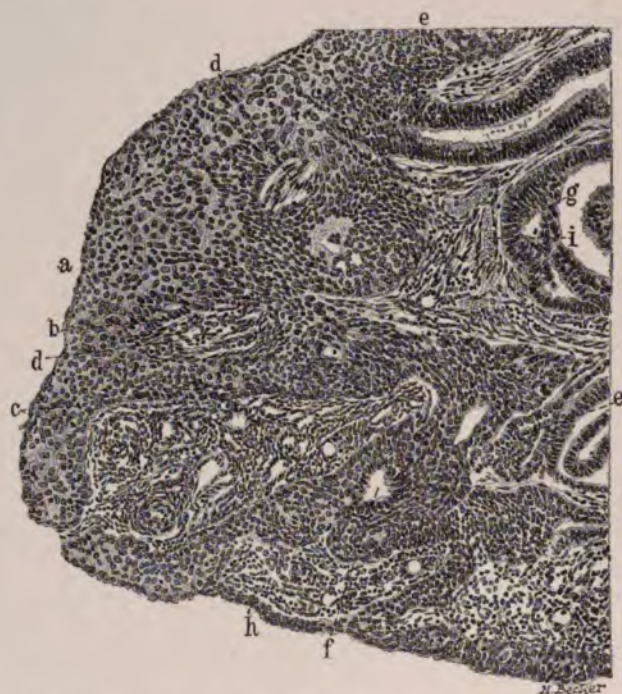


FIG. 84.—ADENOCARCINOMA OF THE BODY OF THE UTERUS. (100 diameters.)

The growth is characterized by the massive proliferation of the surface (a) and gland epithelium, and the almost complete obliteration of the gland lumina (e, f, and g), and the formation of solid masses of epithelium. The somewhat scanty stroma contains numerous dilated blood-vessels (h) and is infiltrated with small round cells. (After T. S. Cullen.)

more diffuse thickening of the endometrium which may have a fairly smooth or granular surface. The cut surface shows the whitish-gray, waxy, or finely granular diseased portion sharply defined from the translucent, yellowish-pink, normal endometrium. Frequently the margin of the growth is marked by a deeply injected zone in the surrounding tissue. The growth may be limited to the endometrium and may even affect only its superficial portion. Usually, however, in cases which have produced any symptoms there is more or less invasion of the uterine parenchyma. As the disease advances the endometrium of the entire body, or of the entire upper portion, is transformed into cancerous tissue, and the cavity is

distended with friable, papillary, or lobulate masses, while the muscular walls are more or less extensively invaded; or there may be a general infiltration of the uterine wall and the inner surface almost wholly necrotic. In rare instances carcinoma originates from the epithelial structures of diffuse or circumscribed adenomyomata, in which event the uterine walls may be infiltrated with cancer without involvement of the endometrium.

It is most important in suspected cancer of the fundus that the cavity should

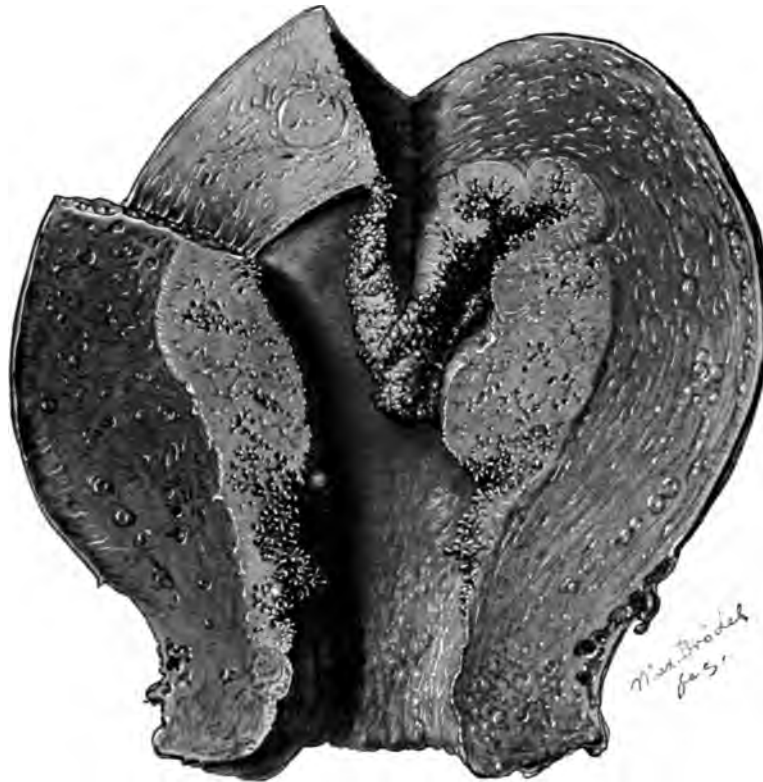


FIG. 85.—ADENOCARCINOMA OF THE BODY OF THE UTERUS.

The uterus, which has been amputated through the cervix, is about twice the normal size. The mucous membrane lining the anterior wall and left side of the fundus is replaced by a new growth which in the older portion consists of a homogeneous solid mass having a fairly smooth necrotic surface, but in the less advanced portions is made up of masses of fine villous or papillary outgrowths. The growth extends to the internal os and invades the muscle to a depth of from 5 to 10 millimeters, presenting a sharply defined, undulating, advancing margin. (After Cullen.)

be thoroughly and systematically curetted, as in the case of an early growth situated in one horn or in the upper angle of the cavity it would be possible to miss the diseased area unless every part were carefully scraped. It is also important that a sufficient amount of the tissue removed should be examined histologically, as in the early cases a large amount of the normal endometrium may also be removed. The quantity of tissue removed has little practical significance in cancer of the body, as many other conditions may produce an equally large amount. The character

of the tissue, however, may reveal the pathologic condition at the first glance. The presence of large or small fragments of a waxy, homogeneous, or opaque granular, friable tissue is practically pathognomonic. Even in the very early cases the tissue is brittle, slightly waxy in appearance, and may present minute yellowish foci of degeneration.

Histology.—Cancer developing in the endometrium may begin in either the surface or the gland epithelium and usually presents a distinctly adenomatous

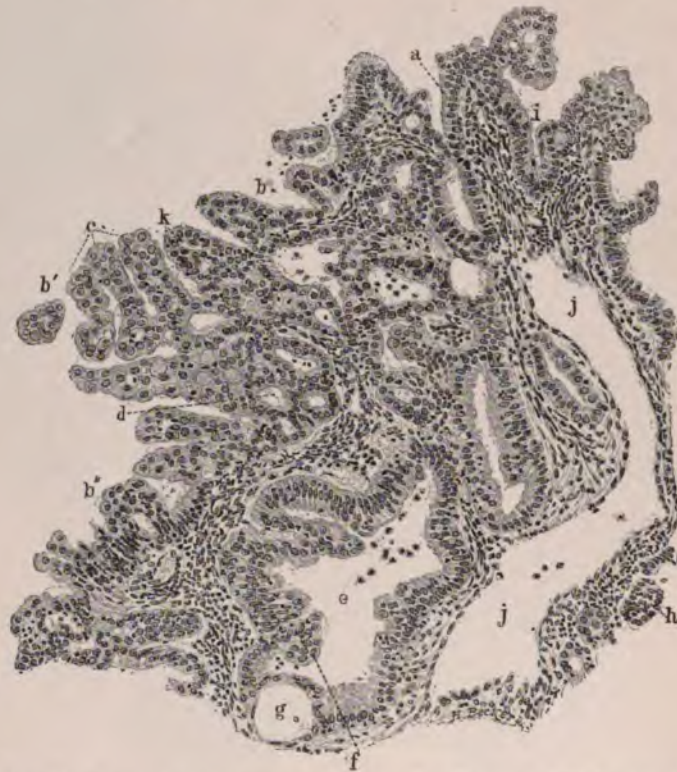


FIG. 86.—ADENOCARCINOMA OF THE BODY OF THE UTERUS. (108 diameters.)

This section shows the proliferation of the surface epithelium (b, c) and the formation of new glands in the thickened epithelium (d) and between the papillary outgrowths (a) where the stroma has grown out into the epithelium. The proliferation of the gland epithelium is seen at (f) and is a dilated space in the thickened epithelium at (g). The rather scanty connective-tissue stroma contains a large, thin-walled blood-vessel (j). (After T. S. Cullen.)

type. The earliest changes may be found in a proliferation of the epithelium or in a change in the character of the individual cells. The epithelial proliferation may appear as little papillary elevations springing from the surface of the mucosa or into the gland lumen, or the glands themselves may show irregular branching without any increase in the number of epithelial layers. In a rather rare form of growth the surface is smooth and the glands branched only slightly or not at all, but some of the glands are moderately enlarged and are lined with two or more layers of epithelium, which may appear to be stained somewhat lightly as compared with

the normal glands in the section, while the nuclei seem larger than those of the normal cells. In other cases, again, the earliest signs of the malignant process are found in the altered character of the epithelial cells. Sometimes the epithelium of only one or two glands is affected. The cells exhibit an abnormal activity, the nuclei are irregular in size, shape, and staining properties, while the protoplasm may also be increased in amount. Usually the epithelial proliferation and the change in the character of the cells are synchronous.

Extension of Uterine Cancer.—Cervix.—The investigations of Sampson,¹ Schauta,² Kermauner and Lameris,³ Ries,⁴ and others, but especially the



FIG. 87.—ADENOCARCINOMA OF THE BODY OF THE UTERUS. (380 diameters.)

A high magnification of an early papillary outgrowth. The epithelium is normal at (a); at (b and d) it has proliferated and forms little papillary elevations; while at (b') a stem of vascularized stroma (d) has extended up into the epithelial outgrowth. The epithelial cells are fairly regular, but around the space seen at (e) vary considerably in size and shape. The stroma contains dilated capillaries (f) and is infiltrated with small round cells (e) and polymorphonuclear leukocytes (h). (After T. S. Cullen.)

elaborate studies of Wertheim and his assistant Kundrat, have done much to explain the method of the local and distant extension of cancer affecting the uterine cervix. Wertheim⁵ gives an analysis of the examination of 345 cases of cervical

¹ Sampson, J.: "Carcinoma of the Cervix," Albany Med. Annals, 1905, vol. xxvi, p. 297.

² Schauta: "Cancer of Lymph Glands, etc.," Monat. f. Geb. u. Gyn., 1904, Bd. xix, S. 475 and 521.

³ Kermauner and Lameris: "Präparate von Beckenlymphdrusen bei Carcinoma colli uteri, etc.," Münchener med. Wochenschr., Nr. 42.

⁴ Ries: Amer. J. Obst., 1901, vol. xlv, p. 29, and Am. Gyn. and Obst. Jour., 1898, vol. xiii, p. 570.

⁵ Wertheim: Paper read before Chicago Medical and Gynecologic Societies, October 10, 1906.



FIG. 88.—ADENOCARCINOMA OF THE BODY OF THE UTERUS. (75 diameters.)

The figure is a section of a papillary outgrowth and shows a central stem (a) of vascular stroma with its secondary branches (b), covered with multiple layers of cylindric epithelium. The proliferating epithelium forms little papillary projections (c) and encloses new glands (f) or forms solid masses of cells (g). The cells are fairly uniform; a few contain large hyperchromatic nuclei. (After T. S. Cullen.)



FIG. 89.—ADENOCARCINOMA OF THE BODY OF THE UTERUS. (130 diameters.)

The growth is characterized by the preservation of the glandular arrangement. The glands are irregularly crowded together, in some places being almost in direct contact with one another; in other places separated by a moderate amount of stroma. The glands are lined with several layers of epithelium (a). (After T. S. Cullen.)

cancer extirpated according to his method. Fifty thousand sections, in series, of the parametrium and the pelvic lymph-glands were examined and the following facts determined: In 40 per cent. of the cases the parametrium and glands were apparently free from cancer; in 20 per cent. both the parametrium and lymph-nodes were invaded; while in 27.5 per cent. the parametrium was invaded without invasion

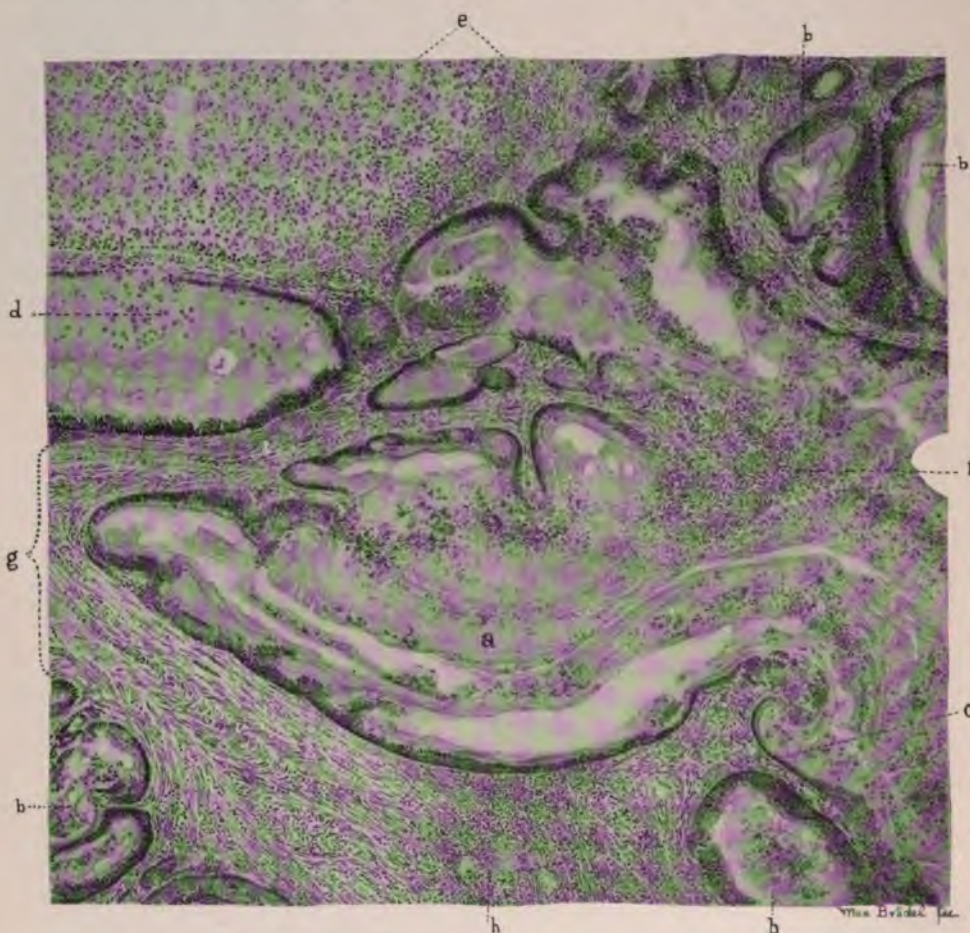


FIG. 90.—ADENOCARCINOMA OF THE BODY OF THE UTERUS.

The section shows a form of carcinoma which is characterized by the unusual preservation of the gland type. The large gland (a) and smaller glands (b) are lined in places with one layer of cylindric epithelium (c), in other places with two or more layers; but there is no tendency to fill the lumen. The glands contain ropy, tenacious mucus, leukocytes, and degenerating epithelial cells. The stroma (g) is infiltrated with small round cells (h). At (e) the gland epithelium is thickened and degenerating and the lumen is filled with cellular detritus. (After T. S. Cullen.)

of the lymph-nodes, and in 10 per cent. the lymph-glands were affected, the parametrium being free.

Sampson examined 27 cases of cancer of the cervix operated upon in Howard A. Kelly's clinic. In 19 of these cases the pelvic glands were removed. In 20 of the 27 cases the growth had extended beyond the uterus, and in 12 there were

metastatic deposits in the parametrium or in the pelvic glands. In 9 out of the 19 cases in which the glands were extirpated, cancerous invasion was found.

It has been frequently demonstrated that there may be no relation between the size of the primary growth and the development of metastases. A very large tumor may be strictly localized, while a small, apparently early one may have given rise to metastases. In the majority of cases, however, where glands are affected the

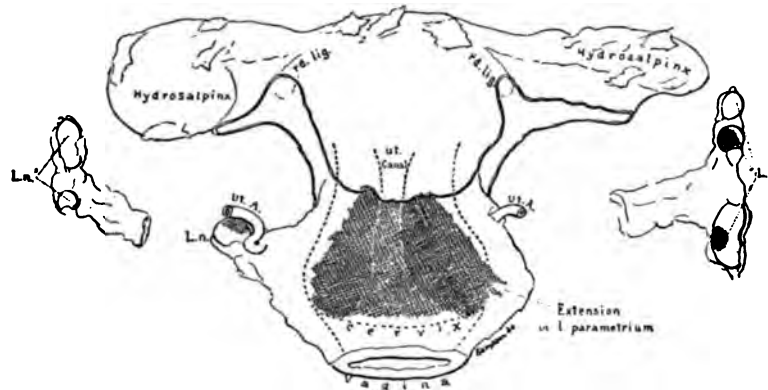


FIG. 91.—RECONSTRUCTION OF THE SPECIMEN REMOVED AT OPERATION. ($\times 3$.) (SAME CASE AS PRECEDING FIGURE.)

The growth has invaded the left parametrium. On the right side a metastasis is found in a large parametrial lymph-node, and on the left side two iliac lymph-nodes contain metastases.

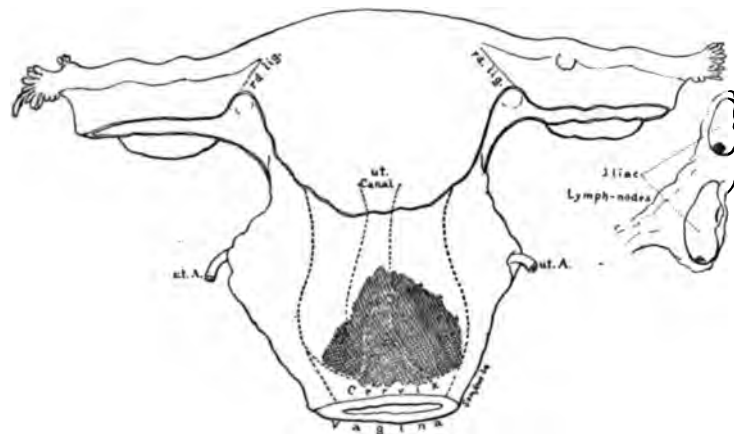


FIG. 92.—SQUAMOUS-CELL CARCINOMA.

Reconstruction of the specimen removed at operation ($\times 3$), showing a small primary growth which has already metastasized to the iliac lymph-nodes. (After J. Sampson.)

disease is advanced. It has been shown by Schauta that the glands nearest the tumor may escape, while others more distant are attacked; and, again, enlarged glands may be merely swollen and hyperplastic, while other small glands contain cancerous foci. According to Wertheim's observations cancer is never found in glands which are unaltered in size, shape, or consistency.

The parametrium, as expressed by Sampson, forms the blood-vascular and lymphatic hilus of the uterus, being in the most direct relation with the cervix. It is in this direction, therefore, that carcinoma of the cervix first extends as it passes beyond the limits of the cervix, either by direct continuity of growth or by means of metastases.

In Wertheim's cases the parametrium was invaded in 47.5 per cent. of the cases and in more than half of these the glands were not affected. In Sampson's cases 9 out of 27 showed invasion of the parametrium, in 8 of these the cancer-cells having passed to the lymph-nodes without attacking the lymph-channels. Kundrat and Sampson describe three types of lymph-nodes which may be found in the parametrium and which may be invaded by the cancerous process.

1. A relatively large node occasionally found where the uterine artery crosses the ureter.

2. Small lymph-nodes of variable numbers, normally present.

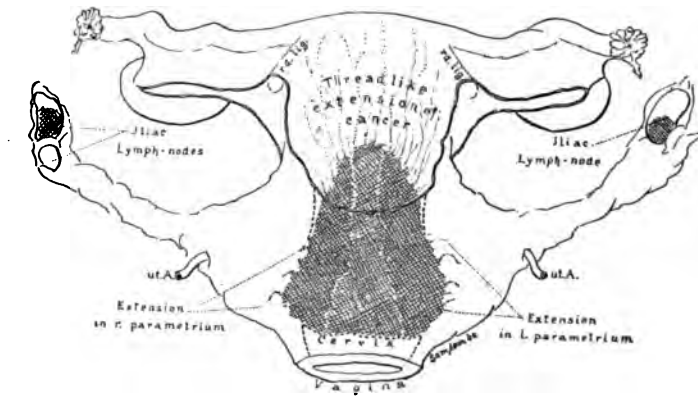


FIG. 93.—SQUAMOUS-CELL CARCINOMA: INFILTRATING MEDULLARY FORM, WITH EXTENSIVE NECROSIS. RECONSTRUCTION OF THE SPECIMEN REMOVED AT OPERATION.

By direct extension the growth has invaded both parametria and the body of the uterus, extending en masse, and as thread-like processes. Metastases in the iliac lymph-nodes on both sides. (After J. Sampson.)

3. Small lymph-nodes developed in the wall of lymph-channels and protruding into the lumen. Sampson found cancer in these nodes in 3 out of 4 cases, and Kundrat in 1 out of 4.

Iliac Lymph-nodes.—The lymph-glands located between the external and internal iliac vessels and the obturator foramen are found to be most frequently invaded in the operative cases, but this may be because they are the ones most frequently removed. A wider dissemination may, however, occur when one node is cancerous, extending to the less easily accessible glands of the hollow of the sacrum or about its promontory, and the iliac glands may even escape while distant ones are affected. In Schauta's cases¹ in 5 out of 21 cases of lymph-gland invasion the abdominal glands were involved while the pelvic glands escaped.

In almost all of Wertheim's cases where lymph-gland invasion was present at the time of operation the disease recurred; whereas, in the absence of lymph-gland

¹Schauta: Monat. f. Geb. u. Gyn., 1904, Bd. xix, S. 475-521.

invasion, 60 per cent. of the patients showed no evidence of recurrence five years after operation.

Local Extension of the Disease.—Carcinoma of the cervix rarely invades the body of the uterus, the internal os marking the upper boundary of the growth. If the disease does extend above this point it is usually into the musculature, either in the form of nodular masses or as slender cords. In rare instances the growth extends superficially over the whole inner surface of the uterus.

Gebhard describes a condition of the uterine cavity accompanying cervical carcinoma which he names *ichthyosis*, and which is characterized by the transformation



FIG. 94.—ADENOCARCINOMA INVADING A MYOMA.

At one point on the upper side of the gland the thickened epithelium resembles the squamous type. (Noble.)

of the endometrium into a multiple-layered atypical epithelium. In the one instance in which a condition resembling that described by Gebhard has come under my observation there appeared to be a direct extension of the carcinomatous process affecting the cervix. This condition may be identical with the leukokeratosis described by Pichevin, or may be a superficial extension of the cervical cancer.

The vagina is invaded early in cervical cancer, the extension being usually by direct continuity, either over the surface or in the deeper structure, and from there extending to the surface. Occasionally, inoculation growths appear to develop, but it is not certain that in some such cases there has not been a retrograde lymphatic metastasis.

The bladder is frequently invaded directly from the anterior portion of the cervix, and in a late stage of the disease sloughing of the vesicovaginal septum is a common event. The rectum is less commonly attacked than the bladder, as it is more or less effectually protected by the intervention of the posterior peritoneal cul-de-sac.

In cancer of the body the invasion of the growth is usually toward the peritoneal surface, which may be studded with nodules before there is any evidence of parametrial invasion. The internal os often marks the limit of the downward extension of growth. Invasion of the cervix, however, is not uncommon. The growth may also extend along the cornu to the uterine tube and the mesosalpinx.



FIG. 95.—A SECTION FROM THE SAME CASE AS FIG. 94, SHOWING AN APPARENT METAPLASIA OF CYLINDRIC INTO SQUAMOUS EPITHELIUM. (Noble.)

The lymph-glands are rarely infected until a late stage. The ones most frequently invaded are the lumbar glands. The inguinal glands may be invaded by transmission of the disease from the cornu by way of the round ligaments.

Uterine myomata, associated with carcinoma of the cervix or body, are often almost entirely surrounded by the malignant growth, but are comparatively rarely invaded by it. The case illustrated by Figs. 94 and 95 is an example of the invasion of a myoma by a cancer of the fundus. An interesting feature of the growth is the apparent metaplasia of the epithelial cells, in one part a typical adenomatous cancer appearing, while in other places the tumor simulates a squamous-cell carcinoma.

Myoma of the Uterus.—Myoma of the uterus is a tumor developing from the smooth muscle of the uterine wall or, more rarely, from the cervix, and is composed of bundles of smooth muscle-fibers with a variable amount of fibrous tissue surrounding the blood-vessels. The tumors vary in size from a few millimeters to 30 cm. or more in diameter. They may be single or multiple, and may be situated in the wall,—interstitial myoma; beneath the peritoneum,—subserous myoma; or under the mucous membrane,—submucous myoma.

The subserous nodules are frequently pedunculate. The pedicle may be broad and short or long and narrow. In some cases it gradually becomes more and more attenuated until finally the tumor is completely separated from the uterus and becomes parasitic, receiving its nutriment by means of adhesions to the abdom-



FIG. 96.—SUBMUCOUS, INTERSTITIAL, AND SUBPERITONEAL UTERINE MYOMATA.

The endometrium below the point of contact of the submucous nodule shows a slight polyp-like thickening (a) which contains a large dilated gland. (After Kelly and Cullen.)

inal peritoneum. The submucous myomata are also often pedunculate and may finally be spontaneously extruded through the cervical canal. The intramural myomata are separated from the normal muscle by a thin layer of loose connective tissue, and are easily shelled out, even the spontaneous retraction of the normal muscle when cut through to the tumor sometimes forcing the latter almost entirely out of its bed. Apparently the only connection between the tumor and its matrix consists of the minute vessels, principally capillaries, which supply the tumor with nutriment. The tumors are usually perfectly spherical, but may be slightly flattened. They are exceedingly dense. The cut surface shows a glistening, white, coarsely fibrillated structure, usually distinctly whorled, and the longitudinal and cross-sections of muscle bundles can often be clearly recognized. The individual tumors may be developed around a single center or may be composed of a number of com-

ponent nodules which have developed from different foci. The blood-supply is scanty, but in rare forms of myoma large dilated blood-sinuses are found in parts of the tumor,—telangiectatic myoma.

The growth of the tumor is expansive and in the simple myomata rarely infiltrating. When the tumor is attached to the peritoneal surface by a narrow pedicle the uterus may be practically normal. With intramural, especially multiple, nodules, the uterus itself becomes greatly hypertrophied, often increasing to several times its normal weight. The uterine cavity, where there are submucous and intramural tumors, may be greatly enlarged and distorted. The endometrium, in the absence of encroachment upon the cavity, is usually normal or only slightly congested. It may, however, be excessively hemorrhagic. With submucous myomata the mucous membrane is thinned out over the most prominent part of the tumor and thickened and injected about its base. Mucous polypi are frequently associated with the



FIG. 97.—SUBMUCOUS MYOMA, PARTLY EXTRUDED FROM THE CERVIX. (After Kelly and Cullen.)

myomata. P. Zacharias¹ describes and figures an unusual form of myoma of the cervix, which appeared as a diffuse myomatous infiltration of the cervix and portio vaginalis, the cervical canal being preserved in the center of the tumor.

Histology.—The low power of the microscope shows that the essential part of the tumor consists of characteristic longitudinal, oblique, and cross-sections of smooth muscle bundles arranged in whorls or running in various directions. There is more or less abundant fibrous tissue, poor in cellular elements, chiefly accompanying the blood-vessels, but also forming a fine network between the muscle bundles and individual muscle cells. This is beautifully demonstrated in the sections stained according to Mallory's method shown by Ribbert.²

The muscle cells resemble those of the ordinary uterine muscle and have similar "*stabchen formige*" nuclei. They appear, however, to be larger than the

¹ Zacharias, P.: "Eine Seltene Form des Cervixmyoms," *Zeit. f. Geb. u. Gyn.*, 1904, Bd. liii, S. 182.

² Ribbert: *Geschwulstlehre*, 1904.

normal cells and have larger, broader nuclei. There is a considerable difference in the cell activity of the myomatous tumors, some appearing dense and fibrous, the muscle bundles distinct, and the cells small with slender nuclei; while others are very cellular, scarcely any cytoplasm is visible, and the closely packed nuclei are large, more rounded at the ends, and often oval in shape.

Degeneration of the Uterine Myomata.—Fibrous and Hyaline Degeneration.—In practically all myomata, whatever the size, fibrous changes associated with hyaline formation of greater or less extent are found. In the early stages the changes may

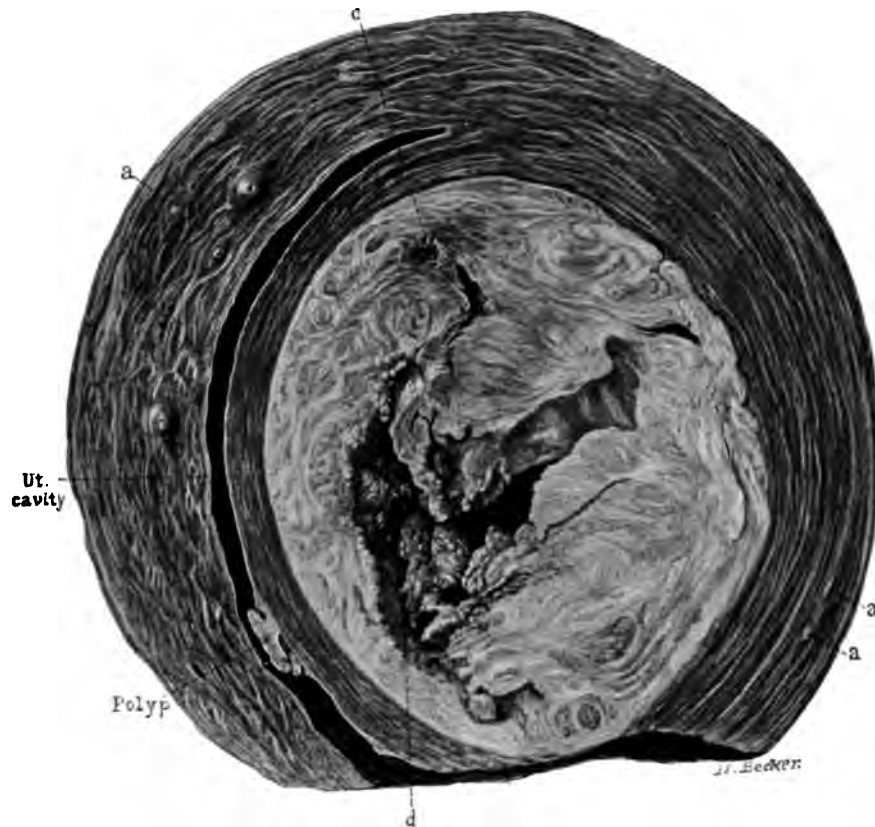


FIG. 98.—INTRAMURAL MYOMA OF THE UTERUS WITH ADVANCED CENTRAL NECROSIS. (Kelly and Cullen.)

not be detected in the gross specimen, but with a more advanced process the tumor is very hard and presents areas of a yellowish-white homogeneous appearance. When the process is very extensive, necrosis of the center supervenes, and, finally, a cyst cavity with irregular softened walls may result. Histologically, there is usually a thickening of the interstitial connective tissue, which is more dense and less cellular than normal, while here and there the characteristic homogeneous hyaline areas are found. The hyaline change may affect a few large areas, or may be found pretty generally distributed between the muscle bundles, or even between the indi-

vidual cells. The muscle cells and bundles, interstitial tissue, and blood-vessels may all, finally, be involved in the degenerative process. The condition is generally ascribed to arteriosclerosis and faulty nutrition of the tumor.

Calcification.—A calcareous deposit is frequently found in myomata and is often associated with fibrous changes in the tumor. The classes of tumors most frequently affected are the interstitial and subserous. The calcareous infiltration may begin in the center of the tumor or at the periphery. There is first a deposit of calcareous granules which infiltrate the fibrous tissue of the tumor. These be-

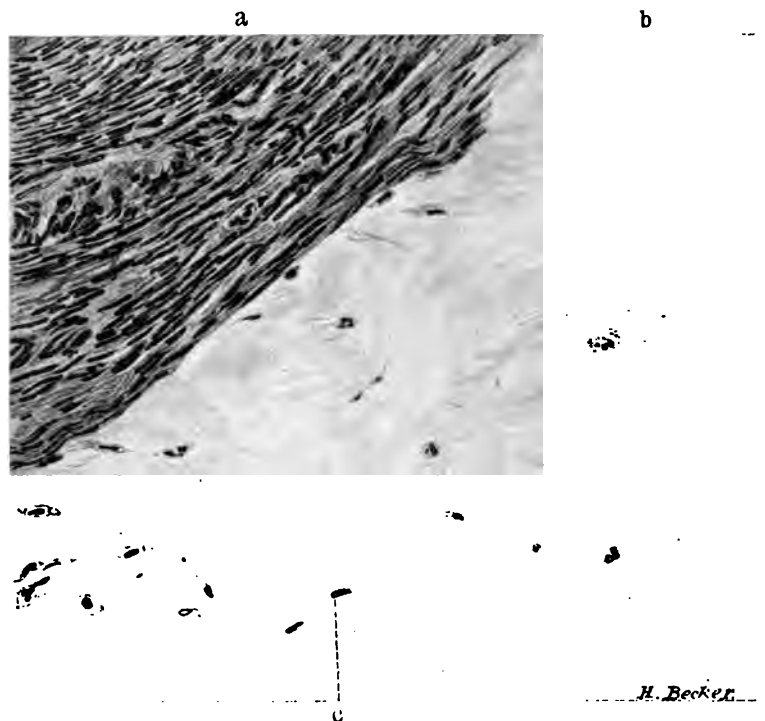


FIG. 99.—MYOMA OF THE UTERUS UNDERGOING HYALINE DEGENERATION.

The section shows the well-preserved myomatous tissue (a) on the left-hand side, and the sharply circumscribed area of hyaline degeneration on the right. In the upper part of the section (b) the hyaline change is complete, but in the lower part a few fibers and cellular elements (c) remain. (After Kelly and Cullen.)

come augmented in size, form concentric plaques, and constantly undergo addition until, finally, the whole tumor may be infiltrated with the granular calcareous material. When the calcareous infiltration begins in the periphery of the tumor it frequently forms a complete shell about the mass, while coincidentally there is sometimes a granular deposit here and there throughout the myomatous tissue. As in the case of central calcification, the calcification in the periphery forms irregular plaques which later coalesce into a single large mass. It is very seldom that the tumor becomes completely calcified. Calcification of the peripheral portion of the tumor

causes almost complete interference with the blood-supply and, as a result, more or less complete necrobiosis supervenes.

Histologically the concentric calcareous plaques, intensely colored with nuclear stain, present a characteristic appearance. They are usually distributed irregularly throughout the tumor in the less advanced stages of the process. In the beginning fine calcareous granules are seen in the fibrous tissue and muscle cells, usually affecting areas which have been partially deprived of their blood-supply.

Edematous and cystic degenerations affect chiefly the subserous tumors, less frequently the submucous, and very rarely intramural growths. The tumor, as a rule, is of considerable size and, according to Piquand, is usually the only one existing in the uterus. The edema is generally regarded as the result of an interference with the return circulation and a passive congestion of the tumor. The macroscopic appearance is fairly constant. The tumor is smooth and rounded, the surface reddish and traversed by a large number of branched blood-vessels. The veins especially are dilated and are full of blood. The consistency is soft, sometimes fluctuant. The edematous transudation may only affect limited areas or may invade the whole tumor. On section the tumor in the early stage simply appears to be slightly softened and a little watery fluid may exude from the interstitial tissue; in a more advanced stage there are extensive translucent, homogeneous, softened areas, and later irregular cavities develop. The tumor may finally be converted into a thin-walled cyst, the interior of which is traversed by thin fibrous bands, which are the remains of obliterated blood-vessels. Microscopically, in the beginning the blood-vessels are dilated, the tissue cells swollen, less vividly stained than normal, and the protoplasm more granular; later the cells are indistinct and irregular, while the nuclei are diminished in size and stained poorly. Finally, the cells become completely dissociated and the few fibers remaining are separated by the serous exudate.

Suppuration is the result of the infection of the tumor by microorganisms from the intestinal canal, from the genital tract, or by way of the general circulation. Direct infection from the intestinal canal is usually produced by prolonged pressure of the adherent tumor with a resulting injury of the intestinal wall which permits the easy penetration of bacteria. The adherent appendix vermiformis has been known to cause suppuration in uterine myomata. Submucous myomata are often infected from without by way of the genital canal. The infection is probably preceded in all cases by trophic degenerative changes in the myoma. Gangrene develops when a tumor which is undergoing coagulative necrosis or other degeneration is attacked by putrefactive organisms.

Fatty Degeneration of Myomata, and Lipomyomata.—Large areas of hyaline degeneration frequently become liquefied in the center, and in the broken-down material fat globules and cholesterol crystals may be found. There have also been a few cases described where a uterine tumor was composed partly of fibromuscular tissue and partly of adipose tissue. In a case observed at the Johns

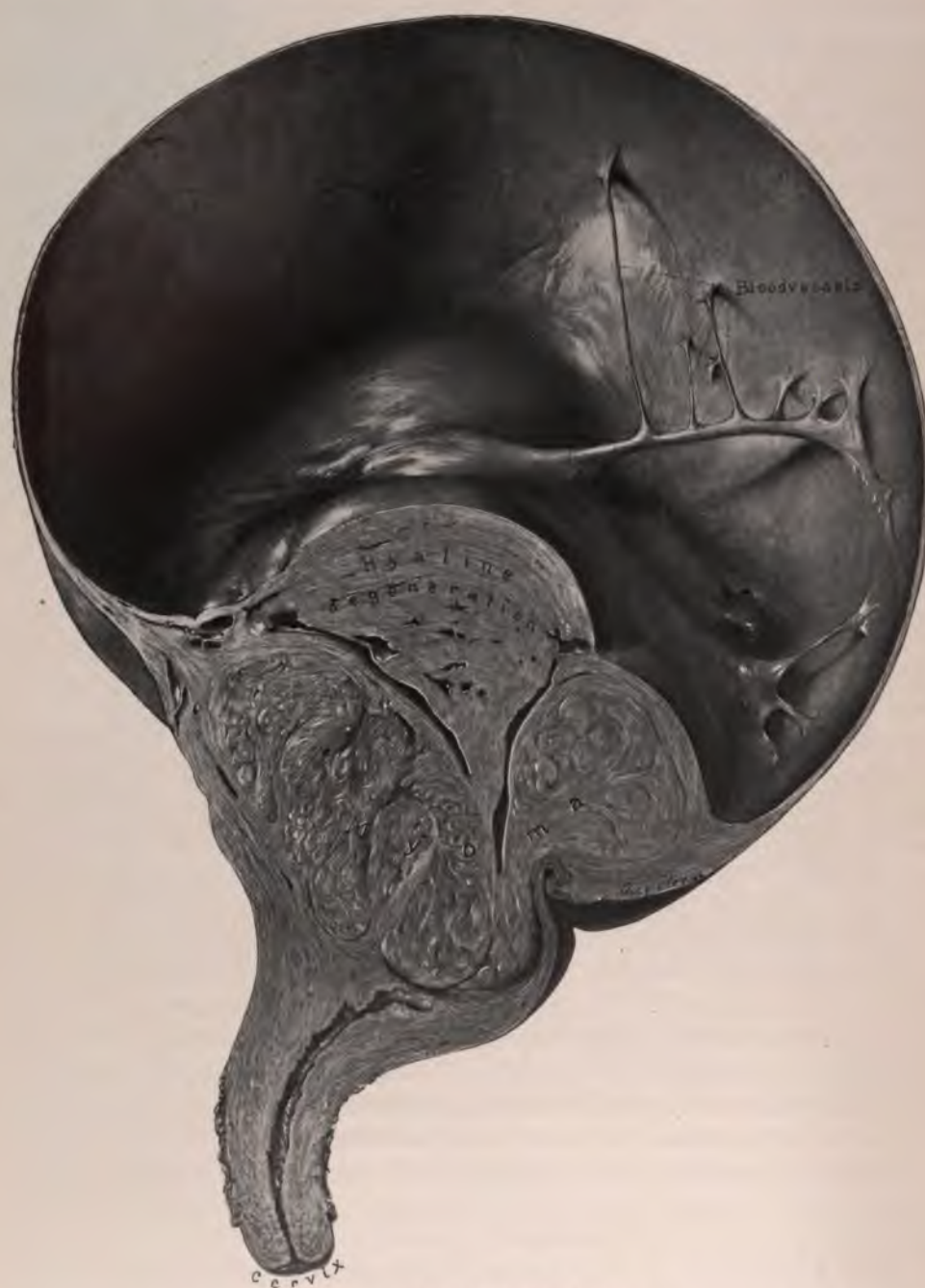


FIG. 100.—CYSTIC UTERINE MYOMA.

The remains of blood-vessels crossing the interior of the cyst indicate that it developed from the degeneration of the solid tumor. (After Kelly and Cullen.)

Hopkins Hospital (Knox¹) a large globular tumor of the uterine wall was made up of typical adipose tissue divided into small groups or even into single cells by bands of smooth muscle with a variable amount of fibrous tissue.

R. Peterson² described a submucous lipomyoma of the uterine wall the size of an orange in a case operated on for procidentia.

Sarcomatous changes occur in from 1 to 2 per cent. of all myomata (see p. 156).

Cancerous changes in myomata are exceedingly rare. It may occur as a secondary invasion of the myoma from an independent cancer of the uterus or it may develop as a primary growth in an adenomyoma.

Adenomyoma of the Uterus.—

Cystic myomatous tumors have been long known, but it has only recently been discovered that in a certain number of these tumors the cyst cavities are lined with a true mucous membrane, while the discovery of glandular structures in some solid myomata is of a still more recent date.

The tumors may be divided into two groups: (1) The diffuse adenomyomata, and (2) the circumscribed nodular adenomyomata.

Diffuse adenomyoma may be limited to either the anterior or the posterior uterine wall, or to the fundus; may involve the entire corpus uteri, or may be situated in the cervix. Füh and v. Franqué (cited by Meyer³) described cases in which the benign adenomyoma extended beyond the uterine wall back to the rectum, which was so infiltrated that part of the tumor was left behind at the operation. The gross appearance of the uterus varies slightly according to the position of the tumor, but in general its normal contour is but little altered. The organ is usually more or less enlarged, and if both walls are involved, it is globular in shape, while if only one wall is affected, there is unusual bulging in the corresponding direction. The uterine tumor is rarely of large size,

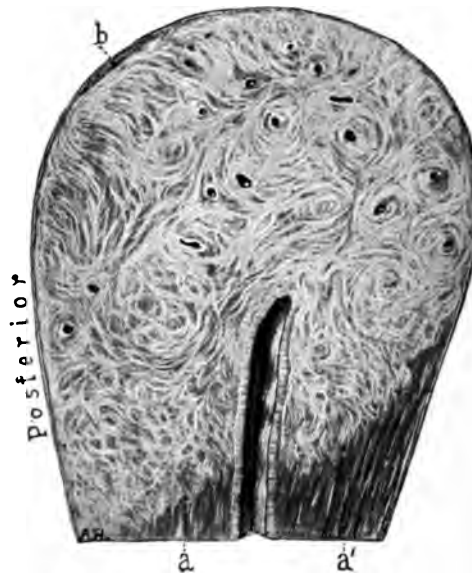


FIG. 101.—ADENOMYOMA OF THE UTERUS.

A sagittal section through the body of the uterus, showing the diffuse myoma occupying the fundus, posterior wall to (a), and upper portion of the anterior wall to (a'). Note the contrast between the dense, white, coarsely fibrillated whorls of the myomatous tissue and the finer, more vascular, normal muscle. With the exception of a thin capsule (b) the entire thickness of the uterine wall is transformed into myomatous tissue in which the openings of glands are plainly visible. The normal contour of the uterus is well preserved and the cavity with its mucous lining appears normal. (Kelly and Cullen.)

¹ Knox, J. H. M.: "Lipo-myoma of the Uterus," Johns Hopkins Hospital Bulletin, 1901, vol. xiv, p. 318.

² Peterson, R.: "Lipo-fibroma of the Uterus," Am. J. Obst., 1904, vol. xlix, p. 393.

³ Meyer, J. S. V.: "Ueber Adenomyoma Uteri," Zeit. f. Geb. u. Gyn., Bd. liii, S. 165.

averaging about 8 or 10 cm. in diameter. In some cases a large portion of the organ may be involved with scarcely any appreciable alteration in its shape and size. It is, however, much denser than normal. The diagnosis can usually be made by means of a superficial examination, as the enlargement, rounded outline, and uniformly increased density, without evidence of a circumscribed tumor, are characteristic of the mass. On section of the uterus the condition is easily recognized, as the difference between the adenomyomatous tissue and the normal muscle is well marked. The endometrium is usually smooth and uniform in thickness, although occasionally attenuated. The outer muscular coats are also normal, but between the endometrium and external muscular layers is a zone of variable thickness which is composed of a dense tissue, coarsely fibrillated, with a whorl-like arrangement of the fibers, and containing here and there areas composed of a homogeneous, translucent, grayish substance resembling mucous membrane. These areas may contain minute cystic spaces from a pin-point to 5 mm. in size, or even a little larger, but the diffuse tumors of the uterine wall seldom contain cysts of any considerable size. These cystic spaces frequently contain a chocolate-colored material, and even when not cystic the glandular areas sometimes show a dark brown discoloration.

Histology.—The tumor is composed of two essential structures,—myomatous tissue and glandular tissue. The myomatous tissue is practically the same as that found in the ordinary nodular myomata, but differs from the latter in its relation to the surrounding uterine muscle, as, whereas the nodular tumors are sharply circumscribed and separated from the normal muscle by a loose connective-tissue capsule, the diffuse myoma merges into the surrounding muscular wall.

The glandular tissue occurs as irregular areas of variable size which lie scattered throughout the tumor but are usually most abundant near the uterine cavity, and, as a rule, are directly traceable to the endometrium. The glands are similar to those of the normal endometrium and are embedded in a cytogenous stroma identical with that of the uterine mucosa. The slight difference in the shape of the glands is readily explained by the conditions accompanying their development. They are of the tubular type, but frequently several tubular glands are seen to open into one principal canal. In some instances these secondary diverticula all enter upon one side of the chief gland, in the manner in which the ducts of the pseudo-glomeruli of the mesonephron communicate with the main canal. This formation is the principal basis of v. Recklinghausen's theory of the Wolffian body origin of the adenomatous structures in these tumors. Quite often there is a large central cavity surrounded on all sides by a glandular structure which corresponds with the normal endometrium, and apparently partakes of the function of the endometrium, the old blood in the cavity, and pigmented cells in the tissue probably resulting from menstrual changes. The glands are lined with a single layer of columnar ciliated epithelium having eosin-staining protoplasm and large oval vesicular nuclei situated just below the middle of the cell. The stroma accompanying the gland is composed of a delicate transparent reticulum containing closely packed small, oval, deeply stained

nuclei. The tissue is supplied with delicate-walled blood-vessels. The new growth extends inward to the base of the endometrium, but rarely invades it. Prolongations of the endometrium, however, extend down into the myomatous tissue and, as we have seen, are directly continuous with the glandular areas.

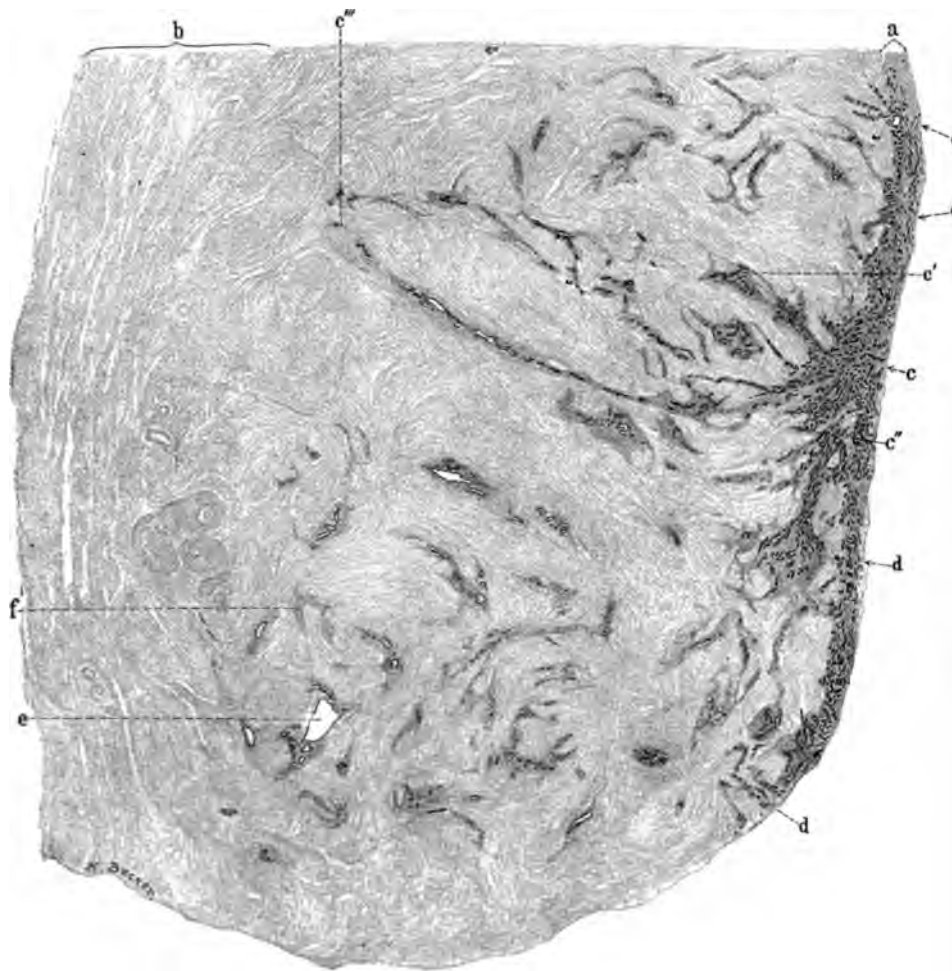


FIG. 102.—ADENOMYOMA OF THE UTERUS.

Section through the uterine wall, showing the endometrium (a), an external layer of normal muscle (b), and the intermediate portion of the thickened wall, consisting of dense myomatous tissue infiltrated with glandular structures which in places appear in isolated masses and are embedded in the myoma, but at other times are directly connected with the endometrium. (Kelly and Cullen.)

Circumscribed Nodular Adenomyomata.—This variety of adenomyomata includes practically all the cystic tumors. They are usually divided into two groups, the intraligamentary and the subperitoneal tumors; but, while of clinical significance, this classification simply refers to the position of the tumor and not to its character. Moreover, in some instances, although more rarely, the tumors are

submucous, while, again, circumscribed subperitoneal tumors may be associated with diffuse interstitial growths. The tumors vary greatly in size, some measuring from 8 to 10 mm. while others fill almost the entire abdomen. The solid tumors in their gross appearance resemble the ordinary myomata, and their glandular structure is usually discovered only when sections are prepared. The naked-eye appearance of the stained section, however, is pathognomonic, as the glands surrounded by their cellular stroma stand out in marked contrast to the muscle.

The majority of these tumors, excepting the very small ones, contain cysts. These may be small, measuring about 5 mm. in diameter, or may take up practically the whole tumor, only a thin fibromuscular capsule remaining. As a rule, the cysts are multiple and not very large. They are lined with a smooth mucous membrane which is usually easily recognized in the gross specimen. The contents may be a clear serous fluid, but a characteristic sign of the true nature of the cyst is the presence of a chocolate-colored thick fluid and a brownish discolora-

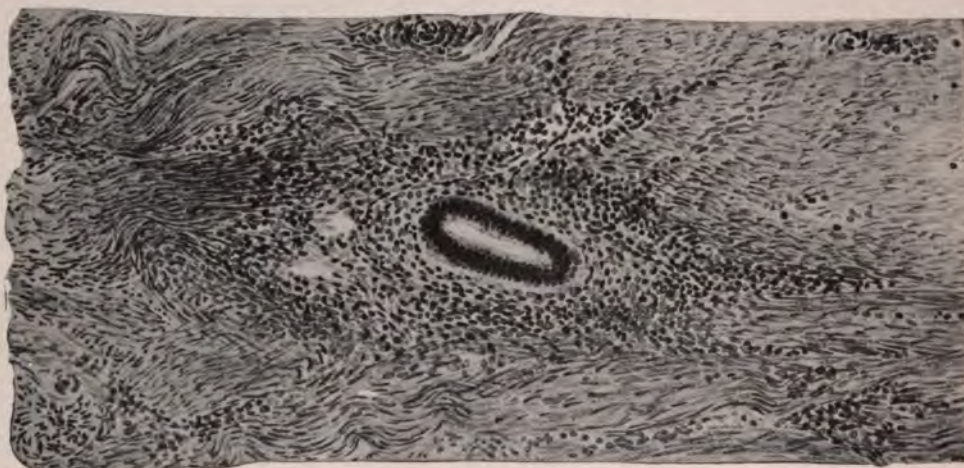


FIG. 103.—ADENOMYOMA OF THE UTERUS. (200 diameters.)

High magnification of a gland lined with columnar epithelium and surrounded by cytogenous stroma identical with that of the normal endometrium. (T. S. Cullen.)

tion of the mucous lining indicating the occurrence of old hemorrhage. Histologically, the circumscribed tumors resemble the diffuse variety.

Histogenesis of Uterine Adenomyomata.—The question of the origin of glandular elements of the adenomyomata of the uterus is still being discussed. v. Recklinghausen,¹ chiefly considering the peculiar form of some of the glands, advances the theory that in the majority of these tumors the glands are derived from the Wolffian body remains, and only exceptionally may be traced to the endometrium. Other writers, while upholding the theory of the Wolffian body origin in some cases, believe that in a considerable proportion the glands are derived from Müller's duct, while others again agree with Cullen in ascribing the origin of the glands almost

¹ v. Recklinghausen: "Die Adenomyome und Cystadenomyome der Uterus, etc.," Berlin, 1896.

exclusively to the endometrium, and thus to the Müllerian ducts. Cullen¹ points out the morphologic and functional identity of the glands and their accompanying stroma with the uterine mucous membrane, which is a highly differentiated structure resembling no other tissue in the body. Moreover, by means of serial sections, the continuity of the glandular structures in the tumor with the endometrium may be easily traced in nearly all cases of diffuse adenomyomata, and, while in the subperitoneal tumors the connection is lost, the structures are precisely the same. Furthermore, subperitoneal tumors have been found associated with diffuse tumors of the uterine wall, and in one such case Lockstadt² was able to trace the glandular elements of a subperitoneal nodule directly down into the submucous tumor. v. Meyer believes that in the majority of cases the glands are derived from the endometrium; in small subserous tumors, possibly from proliferating epithelium of the serosa; in tumors situated in the deeper part of the corpus or in the cervix, from Gärtner's duct; and in the rare tumors which are situated above the round ligament, from the Wolffian body.

The manner in which the tumor develops is also an open question. A plausible theory is that the myomatous tissue offers less resistance than the normal uterine muscle to the downgrowth of the endometrium, which, therefore, extends down into the loose tissue between the muscle bundles. Portions of the endometrium may then become entirely shut off, and finally the whole mass extruded to the external surface, as in the case of subperitoneal tumors. Other writers regard the growth as primarily and essentially an adenoma of the uterine wall, the muscle growth being merely a secondary change.

Sarcoma of the Uterus.—Sarcoma of the uterus is a malignant tumor originating in the mesoblastic structures. It is the rarest form of new growth of the uterus, forming about 2 per cent. of all uterine tumors and about 4.8 per cent. of the malignant growths. The growth, which like carcinoma of the organ may consist of a fungoid outgrowth or of an infiltrating mass, presents a generally uniform, homogeneous structure in contrast to the alveolar formation of carcinoma. In sarcoma the tumor parenchyma is richly vascularized, carrying its own blood-supply; whereas, in cancer the blood-vessels are contained only in the fibrous septa. Furthermore, in sarcoma the individual cells resemble the connective-tissue cell type, while in carcinoma they are epithelial in character. While, however, the differential diagnosis is usually not difficult, there are certain cases of carcinoma in which there is a diffuse arrangement of the cellular elements, and, on the other hand, in sarcoma there may be a more or less distinct, alveolar formation. It may also be impossible to distinguish the cell type, as the sarcoma cells have sometimes an abundant protoplasm and vesicular nuclei, while in carcinoma the cells may be crowded together and only the nuclei be visible.

Classification.—Sarcoma may be conveniently divided according to its location

¹ Cullen: "Adenomyome des Uterus," Berlin, 1903, and Johns Hopkins Hospital Bulletin, 1896.

² Lockstadt, P.: "Ueber Vorkommen und Bedeutung von Drüsenschlauchen in dem Myomen des Uterus," Monat. f. Geb. u. Gyn., 1898, Bd. vii, S. 178.

into (1) sarcoma of the cervix, and (2) sarcoma of the body. Sarcoma of the cervix may be further divided according to its morphology into two groups: (a) an indefinite group comprising the ordinary varieties of sarcoma, (b) racemose myxosarcoma.

Sarcoma of the cervix usually occurs as a diffuse infiltration and

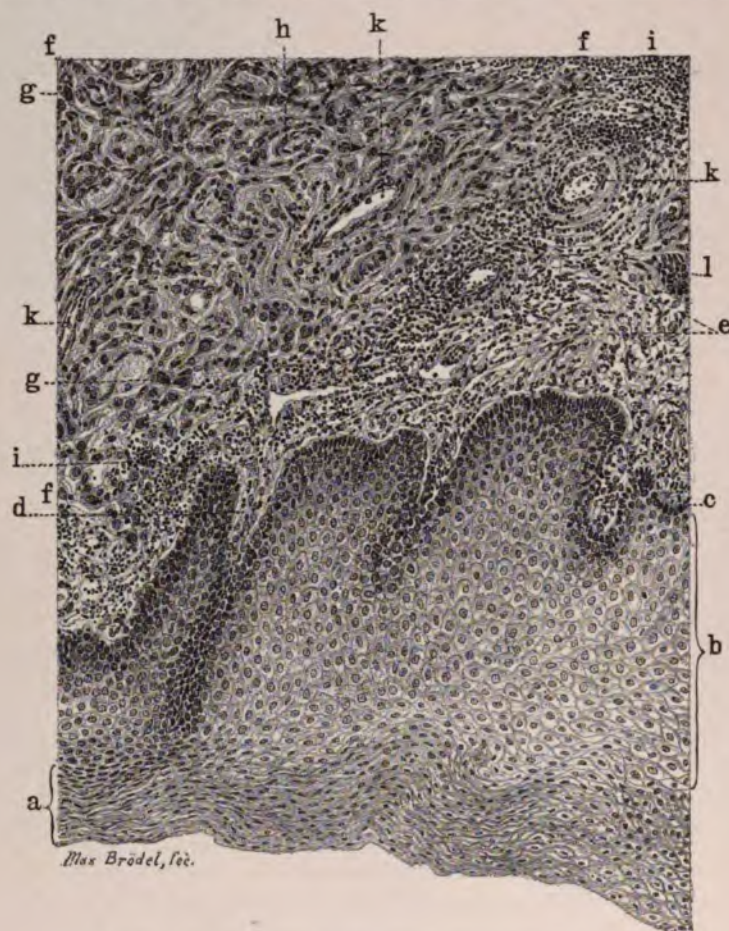


FIG. 104.—SPINDLE-CELL SARCOMA OF THE CERVIX. ($\times 120$.)

The section, which is taken from the margin of the growth, shows the normal squamous epithelium (a, b, c) with normal papillae (d). The stroma immediately beneath the epithelium and on the right side is normal and the cells of the usual size (e). The tumor which occupies the left upper corner of the section (f) and is separated from the normal tissue by a zone of dense round-cell infiltration (i) has a homogeneous structure and consists of large spindle and fusiform cells, interlacing or arranged in whorls around central blood capillaries. The cell nuclei are large, round, oval, or irregular, and stain with variable intensity. (After T. S. Cullen.)

thickening of the mucous membrane or as a circumscribed polypoid growth. Sarcoma of the fibromuscular coat of the cervix is rare. In the diffuse form of growth the mucosa may be uniformly involved, but usually the vaginal portion shows the most extensive invasion. The cervix appears greatly enlarged and infiltrated, the surface sometimes smooth, but often covered with irregular vegetations. Circum-

scribed sarcomata arise from either the anterior or posterior lip and may be either sessile or pedunculate. The former appears as an irregular vegetating outgrowth simulating a carcinoma, the chief points of difference, according to Piquand, being its greater softness and sometimes its greater size with less tendency to necrosis. The pedunculate sarcoma of the cervix (sarcomatous polyp) is the most common variety of cervical sarcoma. It appears as a more or less regularly rounded, sometimes lobulated tumor, which is attached to the portio vaginalis or within the cervical canal by a pedicle of variable length and thickness. It consists of a soft,



FIG. 105.—SARCOMA OF THE CERVIX. (200 diameters.)

The growth is composed of a fibrillated stroma containing abundant spindle or fusiform cells. The cells are irregularly distributed and their nuclei vary greatly in size, shape, and staining properties. Multiple, large, deeply stained nuclei are massed together at (a). In other places the cell is vacuolated and the nucleus pushed to the margin (b). The space seen at (c) is an artefact. (After T. S. Cullen.)

pinkish-gray, homogeneous tissue, or of a dense, but extremely friable, tissue. The early growth has a smooth surface and is covered with cervical epithelium; later, there is more or less extensive degeneration of the surface.

Sarcoma originating in the fibromuscular coat of the cervix is, as has been stated, very rare. The growth may be primarily malignant or may be the result of malignant changes in a preëxisting myoma (see p. 156).

According to the histologic structure, round-cell, spindle-cell, and mixed-cell sarcomata are recognized and are about equally frequent. Giant-cell growths have been described.

Racemose myxosarcoma of the cervix is a similar growth to the grape-like vaginal sarcomata of infants, but, unlike the vaginal tumor, occurs not only in children and young adults, but is also found in women near the menopause. The striking characteristic of the myxosarcoma of the cervix is the development of grape-like clusters of translucent, round or oval polypi. The tumor begins as one or more polypoid outgrowths which arise from the mucous membrane of the cervix or vaginal portion and cannot, in the absence of a microscopic examination, be distinguished from simple mucous polypi. The evolution of the tumor may be very slow in the beginning, but after a longer or shorter period of apparent



FIG. 106.—SARCOMA OF THE UTERUS. (Natural size.)

The normal uterine muscle is seen at (a). The upper part of the cavity is filled with the smooth lobulate sarcomatous mass (b). At (c) and (e) the walls are deeply invaded by sarcomatous masses which appear on the inner surface as irregular, flattened elevations. Smaller foci are seen at (d). The uterine cavity at (f) is lined with granular, roughened endometrium. (After Kelly and Cullen.)

quiescence the characteristic vesicular masses develop, and rapid proliferation is then noted. The tumor mass is composed of two distinct portions, a peripheral part consisting of the translucent pedunculate polypi, and a central stem of denser tissue which is continuous with the submucous tissue of the cervix. As the disease progresses the vaginal vault is distended by the mass and finally the growth becomes disseminated over the vaginal mucosa, penetrates the vesicovaginal and rectovaginal septa, and invades the uterine body and parametrial tissue. The pelvic lymph-glands are occasionally invaded, and in a few instances distant metastases have been found.

Histologically, the growth in general corresponds to the myxosarcomata of the vagina. In a considerable number of the reported cases striated muscle has been found, and the presence of hyaline cartilage was noted by Rein, Müller, Pernice, and Pfannenstiel (Gessner¹). The free surface of the vegetations is covered in part with the cylindric cervical epithelium and partly with the stratified epithelium of the portio vaginalis. There is usually considerable superficial erosion, excepting in the earlier stages.

Sarcoma of the body of the uterus may be divided according to



FIG. 107.—ROUND-CELL SARCOMA OF THE UTERUS.

The section shows a uniform solid mass of small round cells traversed by numerous capillary blood-vessels (a), which divide the tumor cells into irregular alveoli. (After T. S. Cullen.)

its histogenesis into (1) sarcoma originating in the endometrium, (2) sarcoma originating in the fibromuscular wall, and (3) sarcoma originating in preëxisting myomata.

Sarcoma developing in the endometrium appears as a diffuse thickening and infiltration of the endometrium, often accompanied by small vegetations, or as smooth, polypoid or lobulate, more or less definitely circumscribed outgrowths. The growth is soft and very friable, consisting of a homogeneous brain-like substance

¹Gessner: "Das Sarcoma Uteri," Veit's Handbuch, Bd. iii-2, 1 abt.

exceedingly well vascularized. In some instances the vascularity is so abundant that the tumor resembles a telangioma.

Sarcoma of the fibromuscular wall usually occurs as a circumscribed nodular growth, and more rarely as a diffuse infiltration. A diffuse sarcoma of the parenchyma may invade the mucosa and project into the cavity, and is differentiated with difficulty from a primary growth of the endometrium.

Sarcoma developing in a myoma is probably the most frequent variety of sarcoma of the uterine parenchyma. The growth may be multinodular, in which case

part of the nodules may be simply myomata, part pure sarcoma, while others again show the transitional stages between the simple myoma and the malignant tumor. The principal theories which have been advanced to explain the pathogenesis of myosarcoma of the uterine wall are: (1) The sarcoma cells develop by proliferation of the cells of the vessel walls; (2) they develop by proliferation of the cells of the intermuscular fibrous tissue; (3) they develop by transformation of smooth muscle-fibers.

Careful histologic studies of a number of tumors have demonstrated the probability that each of these theories may afford the true explanation of the development of the tumors in different cases. Virchow's theory of the development of the malignant process by multiplication of cells of the interstitial connective tissue has been established by the cases of Ritter, Picher, v. Franqué, and Piquand,¹ and a vascular origin was



FIG. 108.—MYOMA OF THE UTERUS UNDERGOING SARCOMATOUS TRANSFORMATION. (X 200.)

The section shows the transition from the normal muscle-fibers (a, c) into the larger tumor cells (b, d, g). Cells containing two or more imbricated nuclei are seen at (e) and (f), and clumps of large deeply stained nuclei at (h) and (i). (After Kelly and Cullen.)

established in the cases of Kleinschmidt, Pilliet, and others, while in the cases of Whitridge Williams and Piquand there was definite evidence that the muscle-fibers themselves were transformed into the cells of the malignant growth. Ribbert and Pavoit and Bérard, confining the term sarcoma to ordinary connective-tissue cell-tumors, regard the growths which develop by proliferation of muscle-fibers as a distinct variety of tumor, which they designate *leiomyoma malin*. As expressed by Ribbert, the tumor is not due to a degeneration of muscle-cells into

¹ Piquand: Loc. cit.

sarcomata, but is the result of the proliferation of muscle-fibers. In the cases described by Pavoit and Bérard, not the primary tumor only had developed by

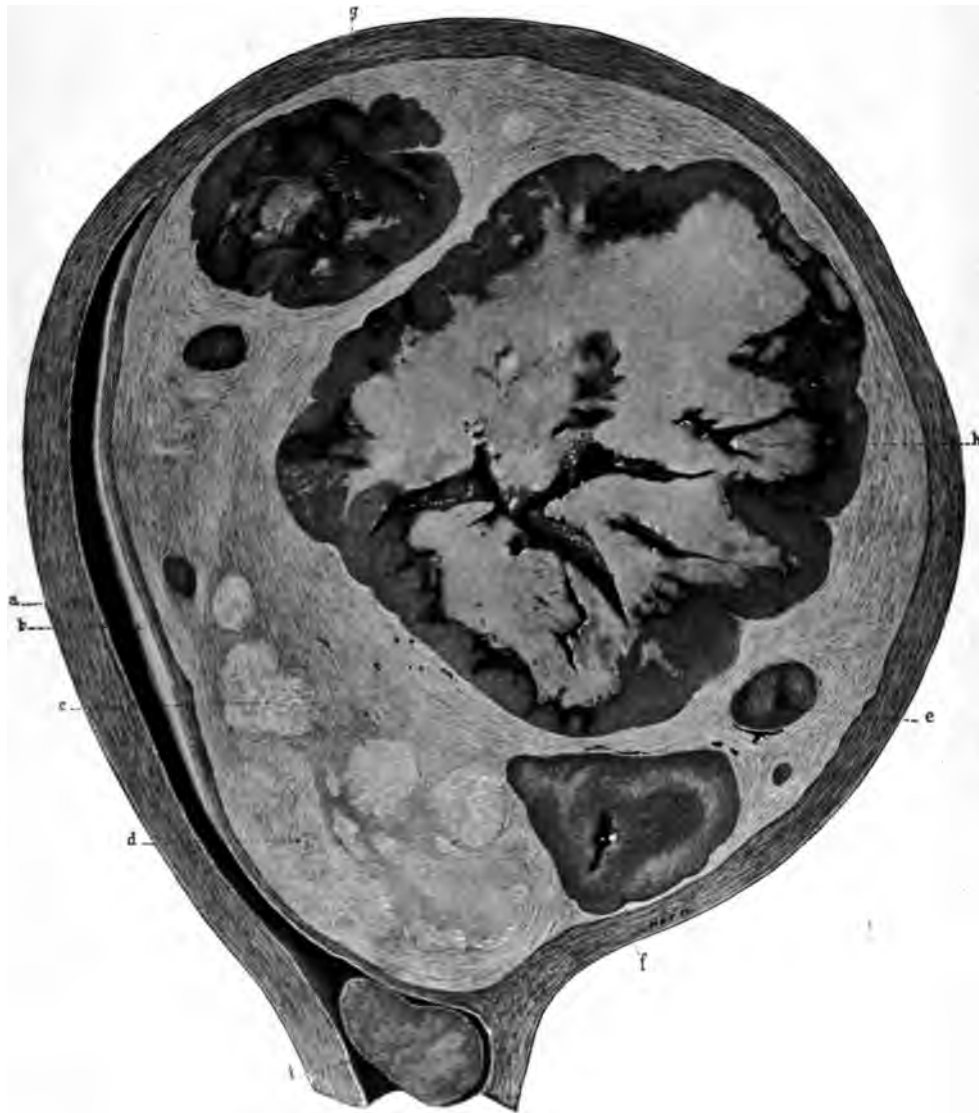


FIG. 109.—INTRAMURAL UTERINE MYOMA UNDERGOING SARCOMATOUS TRANSFORMATION.

The myomatous tumor is sharply defined from the surrounding normal uterine muscle (a). The endometrium (b) is smooth, and is separated from the myoma by a layer of normal muscle. The light coarsely fibrillated areas (c) and (d) are small myomatous nodules which form a component part of the main tumor mass. The darker homogeneous areas (e, f, g) consist of sarcomatous tissue. The large sarcomatous area (h) shows considerable degeneration. (i) is a submucous sarcomatous nodule. (After Kelly and Cullen.)

proliferation of muscle-cells, but the metastatic nodules were also composed of proliferating muscle.

Extension of the Growth.—The sarcoma progresses at first by expansion of the

original tumor, which may be definitely encapsulated, but, later, invasion of the surrounding tissue occurs, and, after removal of the primary tumor, local recurrence is rapid, a large tumor mass sometimes appearing within a few weeks. Metastases occur by way of the blood- and lymph-vessels and frequently attack the lungs. In an instance personally observed, a malignant tumor of the lungs was diagnosed a year after hysterectomy for a supposed multinodular myoma of the uterus, but which a histologic examination had shown to present malignant changes. In a case of round-cell sarcoma of the uterus in a girl of sixteen years, operated upon by Peterson,¹ the glands along the aorta were as large as English walnuts.

Endothelioma of the Uterus.—Endothelioma of the uterus is a tumor which originates from the endothelial lining of the lymph- or blood-vessels. The disease is exceedingly rare in the uterus, only ten or twelve cases appearing in the literature,

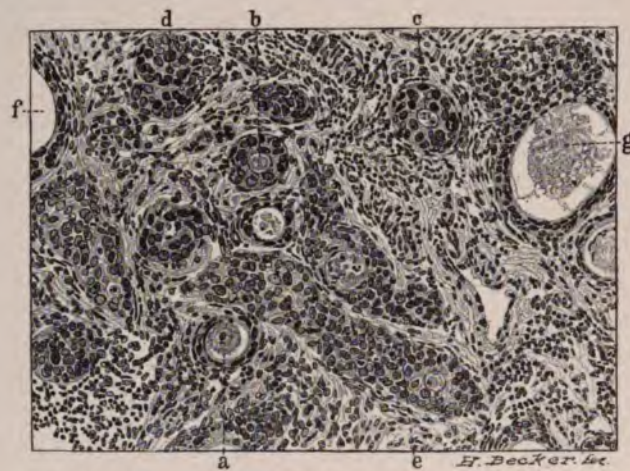


FIG. 110.—ENDOTHELIOMA OF THE CERVIX. (120 diameters.)

The tumor consists of hollow cylinders and round or oval spaces lined with one (a), two (b), or more (c) layers of flat or cuboid cells, embedded in the dense fibromuscular wall of the cervix.

and it is a question if some of these are not atypical forms of epithelial tumors associated with lymph or blood-vascular invasion. The first case was described by Amann² and occurred in a woman of thirty-four years. Braetz's³ patient was eighteen years old. The others were at or near the menopause. In its gross appearance the tumor cannot be differentiated from a carcinoma, and consists of a polypoid or papillary outgrowth or an infiltrating degeneration which produces a dense induration of the tissues. Histologically, the tumor is characterized by an alveolar structure and in its general appearance resembles an adenocarcinoma. It consists of strands, columns, and nests of cells embedded in the tissue of the part. A distinct lumen is preserved in many of the alveoli, which may appear as hollow cyl-

¹ Peterson: "Sarcoma of the Uterus, etc.," *Am. J. Obst.*, vol. xlix, p. 393.

² Amann: "Die Neubildungen der cervikalportion," München, 1892.

³ Braetz: "Ein Fall von Endotheliome der Portio vaginales," *Arch. f. Gyn.*, Bd. lii, S. 1.

inders, or round or oval spaces lined with one or more layers of cells. In other places solid masses of cells are seen, which, from the appearance of organic relation to the surrounding tissue, may be indistinguishable from an ordinary sarcoma. The cells are sometimes flat or cuboid, but may be cylindric and very similar to epithelial cells. They are often very variable in size and shape. A diagnosis of endothelioma of the uterus can be made with certainty only when the growth can be traced directly to the proliferating intima of the blood- or lymph-vessels. A probable origin from endothelium, however, may be assumed when the tumor is characterized by an alveolar structure, associated with an appearance of organic connection between the tumor cells and the surrounding stroma, and when the epithelial elements of the organ are normal and have no evident connection with the new growth.

Chorioepithelioma (*deciduoma malignum*) is a malignant (in some cases apparently benign) tumor which develops after full-term labor, abortion, or the expulsion of hydatidiform mole, or, in rare instances, before the hydatidiform mole is expelled. The tumor was originally described by Sanger,¹ who considered it a sarcomatous tumor developing from decidual cells. Later investigations, however, especially those of Marchand, Gebhard, and Neumann, showed that the characteristic cells of the tumor were identical with those of the syncytium and of Langhans' layer, and the tumors are therefore of fetal origin. The growth is characterized by the development of a small primary tumor, which gives rise to abundant metastases and is rapidly fatal. Both primary and secondary growths appear as dark reddish nodules resembling hematomata. Vesicles, similar to those of a hydatidiform mole, are sometimes seen. Histologically the tumor is made up chiefly of large blood-spaces with walls consisting of large clear cells with vesicular nuclei, and vacuolated protoplasmic masses containing several deeply stained nuclei, resembling syncytium. These syncytial-like masses are especially abundant about the margins of the tumor and invade the surrounding musculature. They exhibit a remarkable tendency to penetrate the vessel walls, and in this way enter the general circulation. The apparently primary growth may develop in the vagina, as in Schmorl's² and Schmauch's³ cases, or there may be general metastases without development of localized tumor, as in cases described by Schmorl. In such



FIG. 111.—HYDATIDIFORM MOLE.
a, pedicle; b, large cyst with small cystic villi (c) and a cluster of cysts (d, e, f, g) attached to it. (After T. S. Cullen.)

¹ Sanger, M.: "Ueber Deciduome," Cent. f. Gyn., 1889, Bd. xiii, S. 132.

² Schmorl: "Ueber Malignis Deciduome," Cent. f. Gyn., 1893, S. 169.

³ Schmauch: "Chorioepithelioma malignum vaginale postpartum Maturum," Jour. Am. Med. Assoc., June, 1904.

a case the primary growth was limited to the placenta, and particles were carried off in the blood-stream, while the primary tumor was expelled.

The two chief theories advanced to explain the origin of the growth are: (1) A special peculiarity of a malignant cell to develop without purpose is ascribed to the epithelial layers of the villi in cases where chorioepithelioma develops after pregnancy, and (2) the trophoblast and its developmental layers preserve the faculty of proliferation, which is a peculiarity of all embryonic tissue during the whole of pregnancy, but display it only in case of certain changes in the material organism (Schlagenhauser). Tumors apparently identical with chorioepithelioma have been reported as occurring in the testicle (Schlagenhauser¹), in ovarian teratomata (Pick²), and in the bladder of a virgin seventy-five years of age (Devitzki³). From these



FIG. 112.—CHORIOEPITHELIOMA OF THE UTERUS. MULTIPLE LUTEIN CYSTS OF BOTH OVARIES. (About $\frac{1}{2}$ natural size.) (After H. A. Kelly.)

observations the theory is deduced that embryonic germs may produce fetal membranes and that the chorioepitheliomata are analogous to the other embryomata.

In the diagnosis of chorioepithelioma the tumor is to be differentiated from other malignant tumors and from other pathologic conditions accompanying pregnancy or the puerperal period. In the gross specimen the dark red or brownish masses, consisting of large blood-spaces, are unlike other malignant growths. Histologically, the diagnosis from curetings alone is practically impossible, as generally only the tissue clinging to the inner surface of the uterus, consisting of the altered

¹ Schlagenhauser: "Chorioepithelioma in Embryoma of Testicle," cited by Schmauch.

² Pick: "Chorioepithelioma in Ovarian Teratoma," *Progressive Medicine*, 1906, vol. vii, No. 2, p. 218.

³ Devitzki: "Chorioepithelioma of the Bladder in a Virgin Seventy-five Years Old," ref. in *Jour. Amer. Med. Assoc.*, 1905, p. 1411.

villi and the superficial degenerated portion of the decidua, are removed. Malignant changes in the chorionic epithelium are almost identical with the changes found in simple hydatidiform mole, and it is impossible from the morphology alone to make a differential diagnosis. Neumann claims that malignancy is characterized by the fact that epithelial cells penetrate the stroma of the villus, but this is not a reliable criterion of malignancy. If portions of the uterine walls are examined, the characteristic blood-sinuses, surrounded by the large clear cells of Langhans and the invading syncytial masses, are easily recognized. But even the development of metastases and the demonstration of the characteristic histologic structure are



FIG. 113.—CHORIOEPITHELIOMA OF THE UTERUS.

The section shows a large blood space in the muscular coat of the uterus, lined with masses of Langhans' and syncytial cells. Large syncytial protoplasmic masses and a few lightly stained Langhans' cells are floating free in the lumen of the blood-vessel.

not positive proofs of malignancy, a condition which, with our present knowledge, can be determined only by the clinical events.

Mixed Tumors of the Uterus.—The association of sarcoma and carcinoma is infrequent, but undoubtedly exists in some cases. Carcinoma which has originated in the endometrium is often associated with myoma of the parenchyma, and, according to some writers, the myoma may be the indirect cause of the malignant change in the mucosa. This observation is apparently confirmed by the fact that myomata are associated with cancer of the body more often than with cancer of the cervix, whereas, in the absence of myomata, the latter is about five times more frequent than

the former. Besides these cases of independent growths, two processes may be combined in a single tumor, as in the adenomyomata, and cancer developing in adenomyoma. A case of teratoid tumor was described by Peukert.¹ The tumor consisted of a polypoid mass attached to the anterior wall of the uterine cavity, and contained young connective tissue, fibrous and myxomatous tissue, smooth muscle, and epithelial structures.

UTERINE TUBES.

The diseases of the tubes include (1) anomalies of form and position, (2) circulatory disturbances, (3) inflammatory diseases, and (4) neoplasms.

CONGENITAL ANOMALIES.

Total absence of both tubes is exceedingly rare and is only found associated with the complete failure or rudimentary development of the other organs. Absence of one tube accompanies the failure of development of the corresponding uterine horn. Rudimentary and atypical developmental conditions of one or both tubes are more frequent than complete failure of development and may exist independently or in connection with other anomalies. In some cases of rudimentary development of the uterus the tube may be represented by a narrow, impervious cord, or the proximal end of the tube may be normal, while the fimbriated end is undeveloped or atypical. On the other hand, the distal end may be normal while the uterine end is imperfectly formed.

Accessory tubes have frequently been described, but in most cases they are probably merely instances of accessory tubal ostia or fimbriæ. True double tubes have been described by Pick, Falk, and Reppler (Gebhard), while Nagel² found a double Müllerian duct in a human embryo. Accessory fimbriated ends communicate with the main canal of the tube, usually entering upon the side to which the mesentery is attached. Two, three, or even five or six tubal ostia are sometimes seen. The accessory ostia are chiefly of interest from their relation to ectopic gestation.

Diverticula of the mucous membrane of the tube occasionally extend some distance into the musculature and appear as small herniæ under the peritoneum. This anomaly is especially of importance on account of its relation to tubal pregnancy.

Small **pedunculate cysts** and wart-like appendages are sometimes found attached to the mesosalpinx. They are lined with high, cylindric, ciliated, epithelial cells with basal nuclei, and their walls consist of fibrous tissue and smooth muscle. Rokitansky and others regarded these cysts as of parovarian origin. Kossmann described them under the name of "nebentuben," and Gebhard advances the theory that they originate from rests of germinal epithelium.

Displacement of the tube may be congenital or acquired. Descensus of the

¹ Peukert, M.: "Eine teratoide Mischgeschwulst des Uterus," Zent. f. Gyn., 1905, Bd. xxix, S. 1335.

² Nagel, W.: "Entwicklung und Entwicklungsfehler," Veit's Handbuch, Bd. i.

ovary, displacement of the uterus, or its asymmetric development, are usually accompanied by anomalous positions of the tubes. It is also displaced in cases of ovarian and intraligamentary tumors.

Hernia of the Tube.—The tube is frequently found with the ovary in a hernial sac, and itself forms the only contents of the sac in about 10 per cent. of the cases of hernia of the female pelvic organs (Andrews¹). The hernia is usually unilateral, and the inguinal variety is the commonest.

SALPINGITIS.

It is impossible to make a satisfactory classification of the different forms of tubal inflammation from the etiologic standpoint alone, as in many cases the pathologic processes excited by the various infecting organisms cannot be differentiated. The two most important varieties of salpingitis are the gonorrheal and the septic or streptococcic. Numerous investigations seem to show that the gonococcus is the most frequent invader of the tubes, but some writers believe that streptococcic infections are equally common. It is possible that while the streptococcus is less frequently found than the gonococcus in tubal inflammations, a large proportion of the numerous apparently sterile cases may have been due to streptococcic infection, in which the organism had died out. Other less frequent causes of salpingitis are micrococcus, pneumococcus, and colon bacillus, either alone or combined with other organisms. Tuberculous infection produces specific lesions, which, while not always characteristic in the gross specimen, are easily recognized under the microscope. The rare actinomycotic infection also produces characteristic lesions. A mild non-suppurative salpingitis and perisalpingitis is a frequent complication of uterine tumors and is probably induced partly by mechanical causes, as in the case of myomata, or by toxic irritation, as in cancer of the cervix. Acute hemorrhagic salpingitis may also accompany the acute exanthemata (Hennig). The possibility that chemical agents used as intrauterine douches may excite a tubal inflammation has been proved by the investigation of Döderlein, and it is also believed by some writers that cold may be an indirect cause of catarrhal salpingitis, but this is questionable.

Acute Salpingitis.—The early changes found in acute infection of the tube consist of swelling, edema, and hyperemia of the mucous lining, accompanied by an abundant watery or turbid exudate. The surface of the tube is reddened and the muscular coats swollen on account of the dilatation of the blood-vessels. At a later stage the gonorrheal and septic infections present more distinctive lesions and can usually be differentiated. The septic infections more often immediately penetrate the muscular coats, attack the pelvic peritoneum, and invade the mesosalpinx and broad ligament, producing a dense infiltration of these structures, often covering the uterus and adnexa with a thick membrane, and forming adhesions with the bowel and omentum. The gonorrheal infection, on the other hand, attacks

¹ Andrews, F. T.: Jour. Amer. Med. Assoc., Nov. 25, 1905.

chiefly the mucous membrane, although at a later stage infiltrating the muscular coats, and usually invades the peritoneal cavity by way of the ostium abdominalis, exciting a localized perioöphoritis and perisalpingitis, which is frequently limited to the fimbriated end of the tube and outer pole of the ovary.

The secretion in the tube lumen soon becomes purulent, the tubal folds are thickened, club-shaped, and granular; the subserous and muscular coats are also thickened and infiltrated, and the whole tube is greatly enlarged. The infection may now subside and a practically complete *restitutio ad integrum* follow. If the infection continues, however, the exudate becomes thicker, the tubal folds become more densely infiltrated, the epithelial covering desquamates in places, and neighboring or opposite folds may become agglutinated. The muscular coats also become much thickened and infiltrated, and occasionally are found to contain minute abscess foci.

Chronic Salpingitis and Residual Condition.—The acute tubal inflammations often result in the persistence of deformities with more or less complete loss of



FIG. 114.—DOUBLE PYOSALPINX. (After H. A. Kelly.)

function. The tube is usually more or less densely adherent to the ovary and pelvic wall and frequently shows exaggerated convolutions, kinks, and twists. The tubal walls may be atrophied, but as a rule are thickened, dense, and rigid. It may be of uniform diameter, or thickened in the infundibular or isthmal portions. In some cases it presents a characteristic nodular hypertrophy (*salpingitis nodosa*); the nodules, which are most frequently situated near the uterine end, are hard, round or elongated, and vary from 7 or 8 to 10 or 12 mm. in diameter. Sections show a dense fibromuscular structure containing irregular gland-like spaces, one of which may sometimes be recognized as the former tubal canal. This condition is to be distinguished from nodular tuberculosis of the tube.

The fimbriated end may become occluded through adhesions produced by a peritonitis or through swelling and agglutination of the fimbriæ resulting from a salpingitis. Often when the tube is found occluded or adherent to the ovary, or in Douglas' pouch, if the adhesions are released, the fimbriæ are found to be free and

normal and the ostium patulous. As a rule, however, especially in gonorrheal infections, the fimbriæ are adherent to each other and there is a true occlusion of the ostium. Obliteration of the uterine end of the canal is usually mechanical and is produced by the swelling of the mucosa, or by kinks and twists of the tube. Complete obliteration of the tube lumen is exceedingly rare, but extensive stenosis of the greater part is sometimes observed. The occlusion of the ends of the tube may be followed by an accumulation of fluid and distention of the canal, forming a pyosalpinx, a hydrosalpinx, or a hematosalpinx, according to the nature of the contents. In other cases, as the inflammatory process subsides, a thickened, distorted, adherent tube remains.

Pyosalpinx (*sactosalpinx purulenta*) may be produced by the closure of the abdominal ostium in cases of purulent salpingitis, or may result from a secondary infection of a non-purulent sactosalpinx. The pus tubes vary from a cylindric mass about the thickness of the little finger to a large, fluctuating, pear-shaped or cylindric mass four or five cm. in diameter and twice the normal length. The thickness of the walls varies greatly; it is not always in proportion to the accumulation of fluid, but depends chiefly upon the extent of the productive inflammatory process in the tubal walls. The small pus tubes may have thick walls, and in some of the large ones the walls are very thick, while in others they are thin, and not infrequently rupture into the abdominal cavity.

The epithelial lining of the tube may persist for a long time, but in a chronic pyosalpinx it is finally almost entirely destroyed and the tube is lined with ordinary granulation tissue. The peritoneal surface of the pus-tube is usually enveloped in an inflammatory membrane and it is adherent to the uterus, ovary, and pelvic wall. In some cases a large pyosalpinx develops which, with the exception of the fimbriated end, is free from adhesions.

Hydrosalpinx (*sactosalpinx serosa*) is the condition of the tube produced when, after complete stenosis of the abdominal end, with or without organic closure of the uterine end, there is an accumulation of serous fluid in the lumen and more or less marked dilatation of the tube. Hydrosalpinx is usually the result of a preceding salpingitis, either of the catarrhal variety or of a more severe form. In some cases, however, perisalpingitis originating from some other source than the tube may cause obliteration of the ostium and a subsequent hydrosalpinx. In the case of complete obstruction, resulting from the presence of tumors, an inflammatory process is usually added. The proximal end of the tube must also be occluded to produce a hydrosalpinx, but there is not necessarily an organized obliteration of the lumen at this point. The stenosis may be merely mechanical, as when due to kinks. This is probably the case in intermittent hydrosalpinx.

The characteristic form of a hydrosalpinx is generally described as resembling a retort having a small uterine end rapidly expanding into a large thin-walled cyst. The mass is usually curved, surrounds the ovary in the concavity, and inclines toward the posterior surface of the uterus and Douglas' cul-de-sac. The inner surface is generally smooth, and here and there presents delicate papillary or folded

elevations which represent the compressed tubal mucosa. Histologically, apart from a slight infiltration and the attenuation of the walls the tissue is practically normal.



FIG. 115.—DOUBLE HYDROSALPINX, WITH ADHESIONS BRIDGING THE ANGLES IN THE TUBES AND BINDING DOWN THE UTERUS BY ITS POSTERIOR SURFACE. (Natural size.) (After H. A. Kelly.)

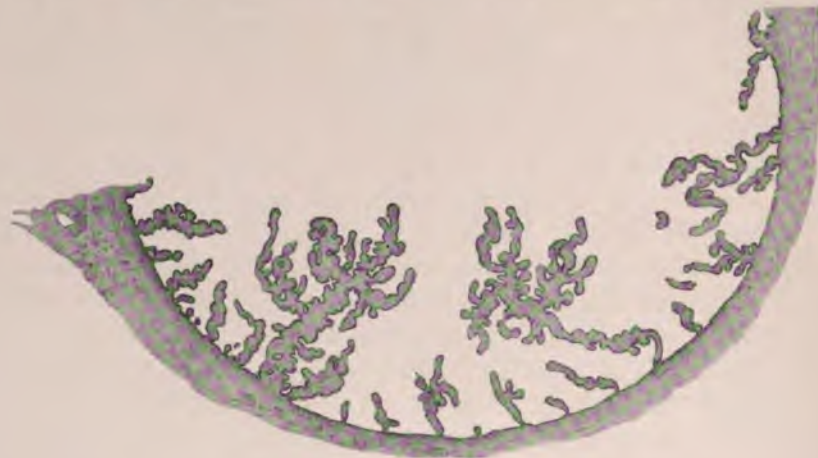


FIG. 116.—HYDROSALPINX SIMPLEX.

The tubal canal is dilated, the mucous folds are delicately branched and perfectly free. The muscular wall is thinned out, but otherwise normal. (After Cullen.)

Hydrosalpinx simplex apparently seldom follows a gonorrheal salpingitis and is probably not preceded by a purulent inflammation. In most cases the abdominal ostium has been sealed by a pelvic peritonitis which was not the result of an

infection by way of the tube but through the lymph-channels in the broad ligament, and it has been found that a large proportion of the cases are of puerperal origin. Kleinhans¹ found that eleven out of fifteen cases were of puerperal origin.

Follicular hydrosalpinx, on the other hand, has always been preceded by a more or less severe endosalpingitis which has resulted in the formation of adhesions between the various folds and the exclusion of a portion of the mucous membrane from the main canal. After the inflammatory process has subsided and the resolution has occurred, the closed-off spaces, as well as the central canal, become dilated with a serous exudate. The tumor in the case of follicular hydrosalpinx is never

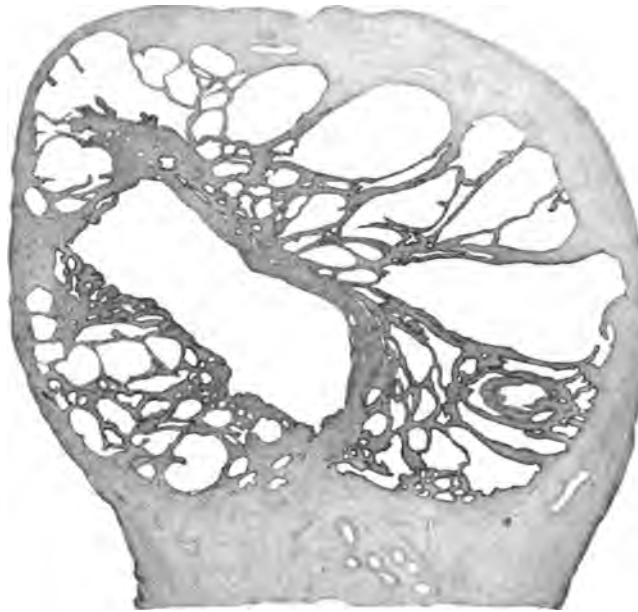


FIG. 117.—HYDROSALPINX FOLLICULARIS. (X 8.)

The tubal canal is represented by the cystic dilatation a little below and to the left of the center. This is lined with flattened epithelium resting upon a layer of dense fibrous tissue and is surrounded by a zone of large and small cystic spaces which have developed between the muscular coat of the tube and the canal, and are the result of the inflammatory cohesion of the mucous folds. (After Cullen.)

so large as in hydrosalpinx simplex; the walls are thicker and less transparent, and fluctuation is not distinct.

Hemosalpinx (*sactosalpinx hemorrhagica*) develops when hemorrhage occurs in a tube having an occluded abdominal ostium and stenosis of the uterine end. Hematomata of the tube, associated with tubal pregnancy or due to the presence of a new growth in the tube, are special varieties of this condition and are considered in connection with the causes which produce them.

Tubal hemorrhage is often the result of displacement, extreme torsion, or kinking produced by peritoneal adhesions unaccompanied by inflammation of the tube itself, and is also found with large uterine tumors, especially myomata. The cir-

¹ Kleinhans, F.: "Die Erkrankungen der Tube," Veit's Handbuch, vol. iii.

culuation is impeded, veins are engorged, and thrombosis and rupture of the vessel result. Hemorrhage may also take place into a preëxisting hydrosalpinx, transforming it into a hematoma. The most interesting variety of tubal hematomata consists of those which are found in anomalous conditions of the genital canal, as in atresia of the vagina or cervix uteri. The pathogenesis of the hematoma in these cases is obscure, but it is generally accepted that hematosalpinx only occurs in cases of acquired inflammatory genital atresia. This theory is important in view of the frequent development of acute peritonitis as a result of the rupture of the tube, so much more frequent than in other varieties of hematosalpinx,—for example, in cases of tubal pregnancy.

Tubal hematomata resemble in their general appearance a hydrosalpinx, but are distinguished by the characteristic bluish-red or dark brown color. They vary greatly in size, the largest reaching the size of a child's head. The surface is covered with fibrinous adhesions. The walls are rather thick, but the tissue is friable. The thickness of the walls is due to the extreme congestion of the blood-vessels and the hemorrhagic infiltration of the tissue. The peritoneal coat often shows the most extensive changes, containing large thrombosed and dilated vessels, and infiltrated with blood or containing a deposit of blood-pigment. The muscular coat is swollen and infiltrated. The mucosa is degenerated and mostly destroyed; the epithelial cells are flattened and often have disappeared, while the stroma is granular, poorly stained, and the cells contain masses of blood-pigment.

Tuberculosis of the Tube.—There is a great difference in the statistics of different writers regarding the occurrence of tubercular salpingitis, chiefly on account of the lack of careful microscopic examination, as in the gross specimen tuberculous disease cannot always be differentiated from simple salpingitis. Where careful routine investigations have been made it is found that from 5 to 10 per cent. of all inflammatory infections of the tubes are tuberculous. Menge,¹ as the result of painstaking investigations, found that out of 70 cases of pyosalpinx, 7 were tuberculous. At the Johns Hopkins Hospital out of 1001 cases of salpingitis 109 were tuberculous. The tube is the most frequent site of genital tuberculosis. W. Meyer found that out of 67 cases of apparently primary genital tuberculosis collected from the literature the tubes were affected in 57, without involvement of the uterus in 15, while the uterus was affected without the tube in only 8. From the etiologic standpoint the infections may be primary or secondary. The source of the secondary infection is a tuberculous focus in another part of the body. From this focus the infection may travel to the tube in various ways. The organism may be carried by the blood (hematogenous infection), as in tuberculosis of the tube secondary to pulmonary disease, or the tube may be infected by continuity or contiguity of structure from a neighboring organ, as in peritoneal tuberculosis or intestinal tuberculous ulcer, to which the tube is adherent, etc. Primary tuberculosis of the tube may be due to the invasion from without, by way of the vagina, or to a localization of infection of the blood or lymph systems. In the ascending infections.

¹ Menge: "Ueber tub. Pyosalpinx," *Cent. f. Gyn.*, 1894, p. 24.

from without, the uterus is usually affected with the tube, but there are cases in which the infection establishes itself in the tube without attacking the vagina or uterus. Mixed infections of the tube—viz., the association of tubercle bacillus with other organisms such as the gonococcus—occasionally occur.

Tubal tuberculosis is generally bilateral. It is seldom seen in an early stage, excepting where it exists as a late infection in miliary tuberculosis. The disease appears in three forms: (1) Miliary, (2) caseous, (3) fibrous. As seen at operation the tube in an early stage may be fairly smooth or is covered with fibrous adhesions. The fimbriæ are often everted, in contrast to the inversion and obliteration of the fimbriated end in other inflammatory processes (Fig. 62). At a later period the surface may be studded with miliary tubercles or may be entirely covered with a thick, fibrinous or caseous membrane. When the tubal affection is secondary to a peritoneal tuberculosis the outer surface is naturally involved from the beginning. The tube may be universally greatly enlarged and very tortuous, or may be small and atrophied in one part, and dilated or nodular in other parts. In some cases only the distal half or third is affected, and the tube may appear normal up to this part. The color is a grayish-yellow where tubercular foci exist, while the surrounding tissue is intensely injected.

Histologically, the characteristic tuberculous nodules are usually found in their most typical form, consisting of a central giant cell surrounded by epithelioid cells, and an outer zone of small round cells. Caseous foci are often noticed and in somewhat infrequent instances the center of the tube consists of a caseous mass, the mucosa being entirely destroyed. More often the tubal folds are thickened and adherent, and the epithelium more or less proliferated. The disease may be limited to the mucous membrane, but generally foci are distributed throughout the muscular and subperitoneal layers.

In some cases a hyperplastic tuberculous process causes almost complete obliteration of the lumen, associated with great thickening of the fibromuscular coats. The disease is usually progressive, but in some cases appears to have been arrested, and retrogressive changes are found. In rare instances an active tuberculosis of the endometrium is found, while the tubes are reduced to an impervious fibrous cord, here and there infiltrated with calcareous material.

Syphilis of the tube has been observed in new-born infants, and in one instance in an adult. The tubes were thickened, the mucous folds adherent, and the musculature contained miliary gummata, and, in the case of the adult, gummata the size of hazelnuts were noted.

Actinomycosis of the tube is exceedingly rare and is apparently never primary. The tubes are converted into abscesses in which the characteristic yellow or brownish-black sago-like granules are readily recognized. Under the microscope the actinomyces is seen in the characteristic granulation tissue.

Echinococcus infection of the tubes is almost always secondary, the disease extending from a hydatid cyst in the pelvis, from the perirectal connective tissue, or from infected organs in the upper part of the abdomen through descensus of the

enlarged organ, or by means of dissemination of daughter cysts over the peritoneum. Benoit collected 80 cases from the literature, and described a case operated upon in which both tubes were enormously enlarged and contained the characteristic hydatid cysts (Kleinhans).

ECTOPIC GESTATION.

The term ectopic gestation includes extrauterine pregnancy and pregnancy in a rudimentary horn of a bicornate uterus.

Extrauterine pregnancy consists in the development of the ovum outside of the cavity of the uterus. The various forms may be classified as follows: (1) Tubal, (2) abdominal, (3) ovarian.

Tubal pregnancy is by far the most common form of ectopic gestation, comprising about 86.7 per cent. of all cases (Edgar¹). Some authors, notably Bland Sutton and Tait,² regard every case as primarily tubal, the other forms developing secondarily after extrusion of the fertilized ovum from the tube. Other writers, however, hold that fertilization of the ovum may occur in the abdominal cavity, in the Graafian follicle, or between the tube and ovary, when adhesions exist between these two structures.

Etiology.—Congenital anomalies and pathologic conditions of the tube which interfere with the passage of the ovum to the uterus are the chief causes to be considered. The relation of congenital hypoplasia, tubal diverticula, and accessory ostia to the development of tubal pregnancy has been referred to above. The residual conditions following an old inflammatory process affecting the pelvic peritoneum, the ovary, or the tube, are apparently the most important causative factors. It is known that extrauterine pregnancy is most frequent in multipara, and usually occurs after a long period of sterility. Rouffart³ found only 9 primiparæ out of 100 cases of extrauterine pregnancy, and comes to the conclusion that a slight puerperal or postabortive infection causes sterility for a longer or shorter period, and conception occurs later only when the disease subsides, but leaves periadnexal adhesions which cause the abnormal location of the ovum. Simon,⁴ examining 23 specimens of tubal pregnancy, found evidence of an antecedent inflammation in all. Runge⁵ also regards the alterations in the position of the tube or in the structure of the tube itself, resulting from a preceding pathologic puerperium or from gonorrheal infection, as the chief cause of ectopic pregnancy. Hitschmann,⁶ in an early isthmic pregnancy, found the small proximal part of the tube thicker and

¹ Edgar: Op. cit.

² Bland Sutton: "Surgical Diseases of the Ovaries and Fallopian Tubes, etc.," London, 1896.

³ Rouffart: "Observations cliniques et Anatomopathologiques de Grossesse extra-uterine," Frommel's Jahrbuch, 1904, p. 775.

⁴ Simon: Zent. f. Gyn., Bd. xlii, S. 1263.

⁵ Runge, E.: "Beitrag zur Anatomie der Tubargravidität," Arch. f. Gyn., 1904, Bd. lxxi, S. 652.

⁶ Hitschmann: "Isthmic Pregnancy, etc.," Zent. f. Gyn., Bd. xxvii, S. 848.

firmer than normal and acutely inflamed, the pus containing gonococci. The distal portion of the tube was normal.

Pregnancy in both tubes, either occurring simultaneously or at different times, is not infrequent, and recurrent cases in the same tube have been reported in a few instances. Hofmeier¹ has described a case where pregnancy occurred in a tube which had been operated upon previously for the same condition, and observed a case of pregnancy in the stump of a tube which had been operated upon for salpingitis. Multiple tubal pregnancy is frequently observed, while coincident intra- and extra-uterine pregnancies are also comparatively frequent.

The ovum is generally situated near the junction of the middle and outer thirds of the tube, but may develop at any point from the intramural portion to the fimbriated end. As the ovum grows the walls of the tube expand, forming a spindle-shaped swelling, and at the same time the musculature hypertrophies. At a later stage a more rounded, circumscribed mass is found attached to the uterus by the proximal normal portion of the tube, as by a pedicle. The mass is usually surrounded by fibrinous adhesions. The growth of the ovum is usually upward toward the peritoneal surface of the tube, but is sometimes downward between the folds of the broad ligament.

Interstitial pregnancy is characterized by the asymmetric growth of the uterus, which is recognizable at an early period. The uterine cavity is dislocated to the unaltered side, and the round ligament extends laterally from the distal side of the gestation sac. If the ovum is located near the uterine ostium of the tube it can, in the course of development, extend partly into the uterine cavity, and finally may be born, either prematurely or at term, in the natural way.

Pregnancy beginning at the fimbriated end of the tube develops partly in the tube and partly in the abdominal cavity—tubo-abdominal pregnancy; or the ovum may be partly in the tube and partly in the ovary—tubo-ovarian pregnancy.

In any extrauterine pregnancy there is a coincident hypertrophy of the uterus and the formation of a uterine decidua vera, which is usually cast off about the second or third month, generally after the death of the embryo, but even while it is developing normally. The uterine decidua, according to Sazeaux, is the better developed the nearer to the uterine end of the tube the ovum is situated, and in ampullar pregnancy is often indefinite.

Histology.—The fertilized ovum is embedded in the tube wall (Werth, Füh, *et al.*) and in the beginning is surrounded by a capsule consisting of the altered tubal folds which form a membrane analogous to the decidua reflexa. Kermanner claims to have found remnants of the capsule in 35 out of 36 cases studied microscopically. Characteristic decidual tissue is found in the tube wall surrounding the ovum, but varies greatly in different cases, sometimes forming a membrane several millimeters thick, at other times being scarcely recognizable. The decidual cells are most abundant in the mucous folds and about the blood-vessels. The tropho-

¹ Hofmeier, M.: "Zur Pathologie der extrauterenschwangerschaft," Berl. klin. Woch., 1905, Bd. xxvii, S. 847.

blast and its derivatives penetrate the mucosa and muscularis and proliferate in the tube walls. The muscular coats are hypertrophied. According to Runge, the hypertrophy is due chiefly to hyperplasia of the individual elements and not to increase in their size. Other observers notice hypertrophy of the muscle cells similar to the changes found in the uterus. The muscular hypertrophy is often irregular and is rarely observed excepting in an early stage. Later, the walls may be thickened at the ends of the mass, but in other areas the growth of the ovum is accompanied by attenuation of the walls and causes more or less pressure atrophy of the tissues. The influence of the trophoblastic cells is usually believed to be the chief cause of the hemorrhage which is noticed in the unruptured tube walls, and is frequently the cause of partial separation of the chorion from the decidua.

Thickening and proliferation of the serosa is noted by Gebhard as occurring in a marked degree in tubal pregnancy.

Evolution.—It is very seldom that the pregnancy proceeds to term, and in most cases the death of the embryo occurs early. The principal cause of the interruption of the pregnancy is the occurrence of hemorrhages, which cause the separation of the placenta and consequently deprive the ovum of nourishment.

A further result of the hemorrhagic infiltration of the gestation sac is the weakening and final rupture of the tube walls when they can no longer withstand the increasing distention. In some cases, on the other hand, the rupture seems to be directly due to the influence of the trophoblastic invasion without the occurrence of hemorrhage. Rupture usually occurs in the upper or posterior portion of the tube, and the products of the conception are partly or wholly extruded into the peritoneal cavity. If the ovum grows downward between the folds of the broad ligament, rupture of the ligament may occur, or the pregnancy may proceed to term, as the ligament affords considerable support. In this case the growth fills the pelvic cavity, lifting up the pelvic peritoneum and in some instances the abdominal peritoneum, the growth being wholly extraperitoneal.

Tubal Abortion.—In early pregnancy, not later than the eighth week, before the ostium abdominalis is closed, the ovum may escape into the peritoneal cavity. According to Aschoff's observations there is no real distinction between tubal abortion and rupture, as in the former rupture of the capsule into the lumen takes place before the ovum can escape, while in the latter the rupture is primarily through the outer wall. The extrusion of the ovum is accompanied by more or less abundant hemorrhage. In some instances the placenta remains partly adherent in the tube and provides nourishment for the fetus, which continues to grow in the abdominal cavity—secondary abdominal pregnancy. Again, the ovum may be extruded into a preëxisting tubo-ovarian cyst and then continue to develop, producing a secondary ovarian pregnancy.

Pelvic Hematocoele.—In some cases, where the entire ovum is not extruded, continuous or repeated hemorrhages occur, and, unless immediately fatal, result in the formation of a diffuse or circumscribed hematoma in the pelvic cavity. The diffuse hematomata develop in the broad ligaments and parametrial tissue. The

circumscribed, or solitary hematocele, is usually situated in the retrouterine cul-de-sac, and consists of a globular mass inclosed in a distinct capsule of organized tissue. In rare instances almost complete absorption of the central blood-clot may occur, and is replaced by a clear serous exudate.

Ovarian Pregnancy.—The fertilization and development of the ovum within the substance of the ovary—*i. e.*, primary ovarian pregnancy—is comparatively rare, but its occurrence has been definitely established in a number of cases. The spermatozoa reach the ovum through a rent in the follicle or penetrate the thin membrane. The criteria which, according to Spiegelberg,¹ are necessary in order to prove ovarian pregnancy are: (1) The tube must be proved intact; (2) the tumor must correspond to the position of the ovary; (3) it must be connected with the uterus by the ovarian ligament; and (4) ovarian tissue must be found in the sac. Williams adds to these conditions that ovarian tissue must be found in different portions of the sac. The fetal membranes are well developed in ovarian pregnancy and the ovum may reach full maturity, although rupture usually occurs. Rupture may be complicated by severe hemorrhage. Death of the fetus may occur and may be followed by its abortion or absorption, while the sac is converted into a cyst; at a later stage of pregnancy fetal parts may be found in the cyst. Secondary ovarian pregnancy has been considered in connection with tubal pregnancy.

Pregnancy in a rudimentary horn of a bicornate uterus is comparatively rare. In 1896 Cullen and Wilkins² reported a case and collected 39 cases, and, in 1900, Kehrer collected 84 cases from the literature. In 78 of the cases the proximal end of the rudimentary horn did not communicate with the uterine cavity, and pregnancy must have followed external migration of the spermatozoa or the ovum (Williams). A decidua forms in the non-pregnant as well as the pregnant horn. Unless there is free communication between the two horns, rupture usually occurs and may be accompanied by fatal hemorrhage. In other cases the fetus may be retained and may even advance to term. After death of the fetus the soft parts may macerate and the bones form an innocuous tumor. Suppuration of the mass may occur, or the hard parts may ulcerate through into the abdominal cavity, the bladder, or the rectum.

Pregnancy in a rudimentary horn may be differentiated from tubal pregnancy by the position of the round ligament, which in the former is connected with the distal side of the tumor instead of the proximal portion.

NEW GROWTHS.

Primary new growths of the uterine tubes are comparatively rare. They may originate in the mucous membrane or in the fibromuscular walls of the tube, and are benign or malignant.

Polypus of the tubal mucosa is very unusual, and the existence of polypi analogous to those found in the uterus is sometimes questioned (Kleinhans),³ some of those

¹ Spiegelberg: Cited from Williams' Obstetrics.

² Cullen and Wilkins: Johns Hopkins Hospital Reports, vol. vi, 1896.

³ Kleinhans: "Die Erkrankungen der Tube," Veit's Handbuch, Bd. iii-2, 1 abt.

described being probably decidual products or simple inflammatory thickenings. Lewers and Amann have described small pinhead nodules in dilated tubes, and in several instances polypi have been noted in association with tubal pregnancy, but whether they existed previous to the pregnancy or were decidual products was questionable.

Papilloma of the tube is a benign tumor which is generally regarded as a product of an old inflammatory process and is not a pure neoplasm. Nine cases of this disease were collected in Macrez's thesis,¹ and since then at least five cases have been reported. The tumor in its gross structure resembles a papilloma of the ovary. It consists of a cauliflower papillary mass which originates

from the mucous lining of the tube and distends the lumen without invading the wall. Partial adhesion of the papillary processes frequently causes the inclusion of small cyst spaces, and in one variety of papilloma described by Bland Sutton the presence of superficial vesicles produced an appearance which simulated a hydatidiform mole. Microscopically, the tumor consists of a fibrillated stroma covered with cylindric ciliated epithelium. The epithelium shows no tendency toward atypical proliferation and is uniform in appearance. Small peritoneal papillomata may develop, but metastases do not occur. Like the ovarian papillomata the tubal growths often produce an

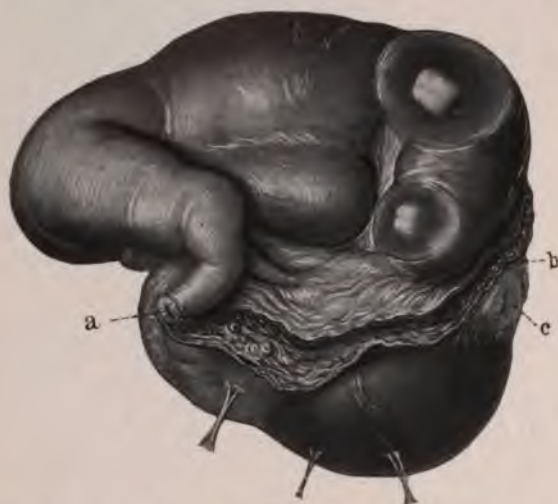


FIG. 118.—PRIMARY CARCINOMA OF THE TUBE. (Natural size.)

The tube which resembles a large pyosalpinx is bent and doubled upon itself and adherent to the ovary (c). The uterine end (a) of the tube is normal for a distance of about 1 cm. It then gradually expands into a cylindric tumor mass, reaching its maximum size about the middle of the tube and becoming slightly smaller at the occluded abdominal end. Two thin-walled cysts are seen near the abdominal end. The ovary contains a large hematoma, and a few dense adhesions are attached to its surface.

ascites. If, however, the abdominal ostium is closed, there is no ascites and the fluid is either retained in the tube or is discharged through the uterus (hydrop tubæ profluens).

Carcinoma.—The older writers were generally of the opinion that primary cancer of the tube did not exist, and no definite instances of its occurrence appeared in the literature until, in 1888, Orthmann² carefully described a case of primary carcinoma of the right tube associated with abscess of the ovary. A number of cases have since been recorded, and in 1905 Doran³ was able to collect 62 cases

¹ Macrez: "Des Tumeurs Papillaires de la Trompe, etc.," Thèse, Paris, 1899.

² Orthmann: "Ueber Carcinoma Tubæ," Zeit. f. Geb. u. Gyn., 1888, Bd. xv, S. 212.

³ Doran, A.: "Carcinoma of the Fallopian Tube," Jour. of Obst. and Gyn. of the Brit. Empire, 1905, vol. vi, p. 285.

from the literature, and at least 8 cases have appeared since. In the pathologic laboratory connected with the gynecologic department of the Johns Hopkins Hospital there are three specimens of primary cancer of the tube as compared with about 400 cases of uterine cancer. In these three cases the disease affected only one tube, but in Doran's table 20, or about a third of the cases, were bilateral. About 90 per cent. of the cases occurred between the ages of forty and sixty. The youngest patient was thirty-five and the oldest seventy years of age. The majority of pathologists incline to the view that an etiologic relationship exists between a chronic tubal inflammation and the development of the new growth. Evidence of an old salpingitis was usually found in the atrophic state of the ostium abdominalis, and sometimes of other portions of the tube, and in most cases of unilateral malignant disease the opposite tube shows more or less extensive inflammatory changes. The cases recorded, however, do not afford adequate support for the

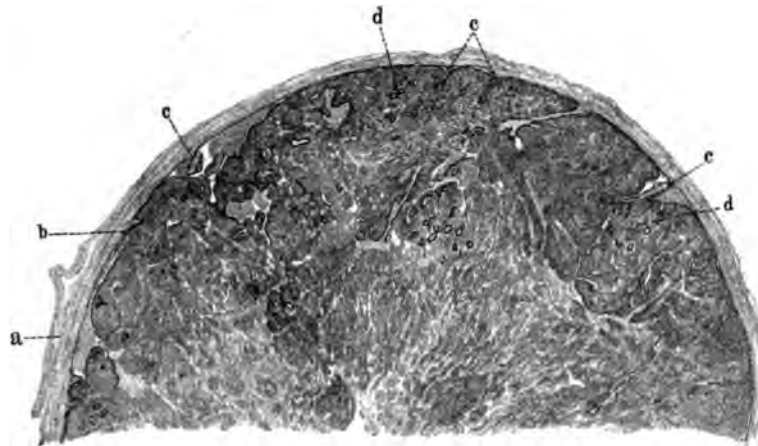


FIG. 119.—CARCINOMA OF THE TUBE.

Cross-section half-way through the median portion of the preceding specimen, showing the thinned-out tube wall (a) inclosing a deeply stained, almost solid mass of carcinomatous tissue.

views that the growth is usually due to malignant changes in a preëxisting benign papilloma, itself an inflammatory product, and I believe that in most cases the tumor is primarily malignant.

Primary cancer of the tube originates from the epithelial covering of the tubal folds and usually develops in the form of a purely papillary tumor, which in its pathologic anatomy is somewhat analogous to the carcinoma invertens of the body of the uterus. The diseased tube is converted into a large cylindric pear-shaped or retort-shaped tumor which may be as large as a child's head, but is usually about the size and presents the external characteristics of a simple sacto-salpinx. Multiple flat or hemispheric metastatic nodules are sometimes visible under the peritoneal covering. On cutting into the tube lumen, soft villous cancerous masses well out. The new growth may be attached only to a small portion of the tube wall, and a large part of the cancerous mass, more or less necrotic,

lies free in the tube lumen. In other cases the tumor is broad-based and appears as a lobulate or mushroom-shaped growth which presents a smooth or finely granular surface. In many cases the growth is confined to the mucous lining of the tube until it has reached a considerable size, but in other cases the tumor while still small has invaded the muscular coats and subserous tissue. Quénu and Longuet¹ described a case in which a fusiform, firm, smooth cancer, the size of a large broad bean, had invaded the muscular coats of the tube and recurred

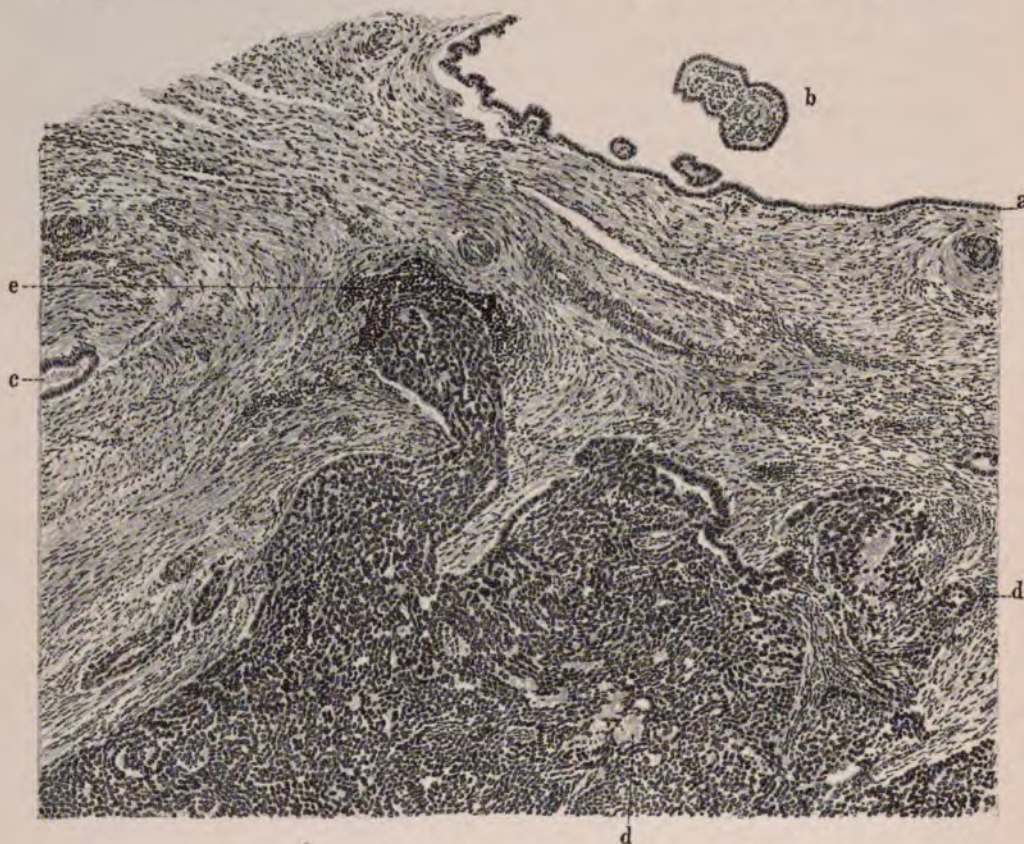


FIG. 120.—CARCINOMA OF THE TUBE. (X 70.) SAME AS THE PRECEDING.
The section shows a portion of the wall of the tube invaded by the carcinomatous growth.

after operation. The extension of the growth may be either by direct continuity or by metastases. As the disease advances, it invades the broad ligament, lodges in the pelvic lymph-glands, or becomes generally disseminated throughout the organism.

Histologically, two fairly well-defined types of growth may be differentiated, the purely papillary (invertens) and the alveolar (evertens); some tumors, however, may partake of the characters of both types. The inverting or papillary tumors

¹ Quénu and Longuet: "Des Tumeurs des trompes," *Rev. de Chir.*, 1901, vol. xxiv, pp. 408 and 742.

are by far the most common form. The investing epithelium is usually described as consisting of a single layer, but in all the cases that I have examined the epithelium was definitely multiple-layered. The cylindric form of the individual cells is usually preserved; sometimes they are flattened or cubical. In the alveolar form of growth the epithelium is multiple-layered and forms solid cell-masses in alveolar spaces; the epithelial cells are atypical and polymorphous.

Embryoma of the Tube.—There are numerous references in the literature concerning the occurrence of bony and cartilaginous tumors, and atheromatous cysts in the tube, but these, as a rule, appear to be merely the products of an old salpingitis or of a tubal pregnancy. There are also several cases of so-called dermoid cyst of the tube, but the descriptions in most instances leave some doubt as to the true nature of the tumor. The cases of Pozzi,¹ Schouwman,² Noto,³ and Orthmann,⁴ appear to be incontestable. Ritchie's case is not wholly convincing, and in Jacob's also there is some doubt. In the cases of Noto, Pozzi, and Orthmann all the embryonal layers were demonstrated. The youngest patient was twenty-five years, the oldest forty-eight years of age.

Orthmann's tumor appeared as an oval or rounded enlargement of the tube, about the size of a hen's egg. On section the tumor mass was for the most part free in the tubal canal, having only a small superficial attachment to the mucosa.

Myoma and fibroma of the uterine tube were frequently described by the older authors, but apparently they were dealing, in most cases, with the small nodular thickenings resulting from inflammatory conditions. Taylor described a walnut-sized myoma which was concentrically arranged around the tube-lumen and was separated from the uterus by the normal tube. In Bland Sutton's case of myoma of the tube the tumor was as large as a Tangerine orange and was situated between the uterine end and middle third of the tube. v. Recklinghausen, in his monograph on adenomyoma and cystadenoma, described a special form of small adenomyoma of the tube and of the tubal angle. The tumors varied from 5 or 6 to 15 or 20 mm. in size and occurred either as circumscribed nodules or more diffuse growths. Histologically, they were characterized by the presence of myomatous tissue containing glandular structures surrounded by a more or less abundant cytogenous stroma. As these tumors are morphologically analogous to the adenomyoma of the uterus, a more detailed description may be found in connection with that subject.

Fibromyxoma of the Tube.—Sänger and Barth⁵ have described a case of fibromyxomatous tumor arising from the tubal fimbriæ. The tumor, which was made up of a mass of component parts, was about the size of a fist. The outer surface was covered with ciliated epithelium. The deeper structures consisted of a fibrillated tissue containing large cystic areas due to edematous degeneration.

¹ Pozzi: "Traite de Gynecologie," Paris, 1897.

² Schouwman: Cited from Orthmann.

³ Noto: Cited from Orthmann.

⁴ Orthmann, E. G.: "Ueber embryoma tubae," Zeit. f. Geb. u. Gyn., 1904, Bd. liii, S. 119.

⁵ Sanger, M., and Barth, J.: "Die Neubildungen der Eileiter," Leipzig, 1895.

Sarcoma of the tube, like other connective-tissue tumors, is exceptionally rare. There are five cases reported in the literature, two round-cell, one spindle-cell and one myxosarcoma. Janvrin's case was situated in the tube wall; the others originated in the mucous membrane, and, like other tumors originating in the tube, presented a papillary or polypoid structure. The histologic descriptions in Sanger's and Senger's cases permit some question as to whether they were not dealing with carcinomatous growths.

Chorioepithelioma of the tube, as a sequence of tubal gestation, seems to be relatively as frequent as chorioepithelioma of the uterus following uterine pregnancy. Risel¹ collected ten cases and added a new one. In a few cases the disease has been associated with cystic degeneration of the chorion. The macroscopic appearance is characteristic; in the place of the tube there is a large sac, with thin, friable walls, which encloses a soft, friable structure resembling placenta, and masses of bloody, fibrinous material. The histologic picture is identical with that of chorioepithelioma of the uterus.

DISEASES OF THE OVARY.

The ovary contains an extraordinary variety of energetic cellular elements, and varies in its morphology and in its functional activity at different periods of life. It is subject to a corresponding variety of pathologic processes, and while most frequently attacked by disease during the reproductive period, it is exempt neither in infancy nor in old age. The pathologic conditions affecting the ovary may be classified as follows: (1) Anomalies, (2) circulatory disturbance, (3) inflammatory disease, (4) retention cysts, (5) proliferating tumors.

CONGENITAL ANOMALIES.

Anomalies of the ovary are generally accompanied by defective development of the other organs of generation. Absence of both ovaries is usually associated with the absence or rudimentary condition of the tubes and uterus. Absence of one ovary is associated with the absence or rudimentary condition of the corresponding tube and uterine horn.

Infantile development of the ovaries and other pelvic organs is due to congenital conditions, and is often found in cases of amenorrhea occurring in well-developed, robust girls.

Displacement of the ovary may be congenital or acquired. The high position of the ovary in fetal life and infancy may persist and is usually associated with imperfect development. Prolapse of the ovaries is generally dependent upon conditions which cause prolapsus of the other pelvic organs and may be congenital or acquired. Enlarged cystic ovaries in infants or older individuals often lie low down in Douglas' cul-de-sac.

¹ Risel: "Primaren Chorioepithelioms der Tube," Zeit. f. Geb. u. Gyn., 1905, Bd. lvi, H. I, S. 154.

Hernia of the ovary is comparatively common and may be congenital or acquired, and of the inguinal, femoral, or obturator varieties. The most common form of hernia is the inguinal, and the ovary may be found in the labium majus or in any part of the canal. The attention may be first directed to the condition by the congestion and swelling of the ovary at the menstrual period. Very often, however, strangulation occurs, even during infancy, and the hernial mass becomes swollen, tense, and painful. Heath removed a cystic ovary the size of a walnut from a hernial sac in an infant of two months.

CIRCULATORY CHANGES IN THE OVARY.

Edema of the ovary is found in cases of displacement and is the result of some slight circulatory disturbance, probably due to mechanical influences. It also sometimes occurs in the course of acute infectious diseases.

Congestion and Hemorrhage.—Apart from the hemorrhagic condition depending upon acute infections, a passive congestion of the ovary, sometimes accompanied by extensive interstitial or follicular hemorrhage, may be induced by mechanical influences, especially torsion of the pedicle, the constriction by adhesions, or the presence of tubal or uterine tumors. The herniated ovary is often excessively hemorrhagic, and may be entirely disorganized by the hemorrhagic infiltration.

Hypertrophy of the ovary may be due to a chronic inflammation, the result of bacterial invasion. It may, however, be the result of a chronic hyperemia depending upon mechanical influences. The ovarian hypertrophy so frequently accompanying uterine myomata is thought by Bulius (Gebhard) to be a special condition which is not secondary to the myoma formation in the uterus, but is an independent condition induced by the same cause that induced the myomatous growth. These changes, according to Bulius, are characterized in the gross specimen by a constant enlargement of the ovary, especially marked by its increased thickness. Histologically, there is a cellular hyperplasia of the stroma which in the majority of cases consists of a dense fibrous tissue very rich in spindle-shaped cells. There is also a disappearance of the primordial follicles, and degeneration of the vessel walls. The condition is probably due to chronic congestion.

INFLAMMATION.

Many distinct pathologic conditions of the ovary are clinically included under the term oöphoritis, and especially the changes depending upon simple circulatory disturbances. The term oöphoritis I have applied here only to such pathologic processes as are caused by the direct invasion of microorganisms or the absorption of the toxic products of microorganisms. These conditions may be divided into two groups: (1) Acute oöphoritis, and (2) chronic oöphoritis.

Acute oöphoritis is characterized by swelling and congestion, infiltration with leukocytes, and a serous or bloody exudation. In severe infections degenera-

tion and abscess formation follow. The surface of the ovary is covered with a fibrinous, serofibrinous, or fibrino-purulent exudate, and is usually glued to the surface of the tube, broad ligament, and posterior surface of the uterus, or to the pelvic floor. The organisms most frequently causing this acute process are the streptococcus and the gonococcus. Other organisms sometimes found are bacillus coli, typhoid bacillus, and pneumococcus, also some anaërobic forms. Actinomycosis of the ovary has been described by one or two authors. Tuberculosis is comparatively frequent. General infectious diseases, especially the acute exanthemata, cholera, etc., may be accompanied by acute degenerative changes in the ovary; in severe cases of measles, scarlet fever, or diphtheria, metastatic abscesses some-



FIG. 121.—OVARIAN ABSCESS (natural size).
Puerperal infection six weeks previous to operation. The tube is practically normal.

times develop. The most important of the acute infections of the ovary are the streptococcic and the gonorrheal.

Streptococcic infection of the ovary, or septic oöphoritis, is most frequently a puerperal infection or the result of an operation upon the genital tract. It is especially frequent after criminal abortion. The infection atrium is usually a lesion in the cervix or vagina, the microorganisms traveling chiefly by way of the lymphatics of the parametrium to the hilus of the ovary. The disease is therefore often limited to one side and may be confined to the ovary (Fig. 121). The ovary may also be involved in a pelvic peritonitis and invaded directly through the germinal epithelium. With a septic metritis a septic thrombophlebitis may produce the ovarian disease. The entire organ is swollen, hyperemic, and edematous, and

is infiltrated with polymorphonuclear leukocytes. The follicular epithelium degenerates, and the contents of the follicle become cloudy and purulent. If the infection is severe, degeneration and abscess formation supervene. Small abscess foci may originate either through the degeneration of areas of stroma or through suppuration in a follicle. Very often the small foci of suppuration coalesce and a single large abscess occupying practically the whole ovary develops. When the disease in the ovary is only a part of a general pelvic infection, the surface of the ovary is also involved, and there is found a septic periovaritis, with adhesions to the neighboring structures. If the patient survives the septic condition, the destructive process subsides, the exudate becomes absorbed, and a small sclerotic ovary bound down by adhesions may be all that remains.

In the other instances a small, more or less quiescent abscess remains, forming a constant source of infection.

Gonorrheal Oöphoritis.—The ascending gonorrheal infections in women attack chiefly the mucous lining of the pelvic organs, and the ovarian infection is usually secondary to a pelvic peritonitis caused by the dissemination of the infection through the fimbriated ends of the tubes. The perioöphoritis produced in this way may subside without causing further disease of the ovary, but in some cases infectious organisms invade the ovarian tissue and a gonorrheal oöphoritis develops. It is also probable that the gonococcus may reach the ovary by way of the parametrial, uterine, and tubal lymph-channels. In other cases again the fimbriated end of the tube becomes adherent to the surface of the ovary, and it may be to the thin wall of a Graafian follicle, which becomes directly infected. The ovary may also be directly invaded through the walls of a pyosalpinx to which it is adherent, and a tubo-ovarian abscess is then formed.

As the gonorrheal infections are rarely fatal, there is seldom an opportunity to study the early acute stages of the disease. Later in its course the affection is characterized by localized abscess formation. The ovary is often found embedded in adhesions, but otherwise may be practically normal. At other times it is sclerotic, as a result of an old inflammation, and again it is partly or completely destroyed by a suppurative process and contains one or more small abscess foci, or a single large pus cavity.

Chronic oöphoritis is the term applied to the various residual conditions following a septic, saprophytic, or gonorrheal infection. The most characteristic result of the acute infection is the production of periovarian adhesions and sclerotic changes in the substance of the ovary. The ovary may be represented by a small shriveled organ about half the normal size, and microscopically is composed largely of dense fibrous tissue, while the follicles have been almost entirely destroyed. In other instances the condition is characterized by fibrocystic changes. The ovarian stroma is dense and fibrous, and may either be diminished in amount or may be hyperplastic. There are few, if any, normally developing follicles, but the ovary contains one or several small cysts varying from the size of a pea to a centimeter or more in size. These cysts may be situated in the center or upon the sur-

face of the ovary, and are dilated follicles which probably have degenerated on account of the adhesions and the fibrous changes in the stroma.

Tuberculosis of the Ovary.—Ovarian tuberculosis develops most frequently between the ages of fifteen and thirty. It occurs occasionally, however, in early childhood and after the menopause. Compared with the infection of the tube, ovarian tuberculosis is infrequent. It is not, however, so infrequent as it was formerly supposed to be, as recently more careful histologic examinations have revealed microscopic tuberculous foci in the macroscopically normal ovary. The records of the Johns Hopkins Hospital show 25 cases of ovarian tuberculosis, as compared with 109 cases of tubal disease. The ovarian infection is generally less advanced than the accompanying tubal disease, which is probably in the majority of cases the source of the infection in the ovary. Primary tuberculosis of the ovary is exceedingly rare. There are, however, a few cases reported in which the disease in the pelvic organs was limited to the ovary, but in these cases, although the patient exhibited no signs of tuberculous disease elsewhere, the existence of a small primary focus could not be excluded without autopsy examination. The ovary may be infiltrated with a few miliary tubercles and present a practically normal appearance, or it may contain caseous or fibrous foci, or may be transformed into a large abscess-sac having thick walls lined with tuberculous granulations and caseous material.

Tuberculous invasion of ovarian cysts is sometimes observed and is usually due to the dissemination of a peritoneal tuberculosis. F. Prüssmann¹ collected 13 cases, including a personal observation, in which the tuberculous disease appeared to be primary in the tumor.

Echinococcus cyst of the ovary has been found in association with echinococcus disease of the pelvic connective tissue, and in rare instances the disease appears to be primary in the ovary.

RETENTION CYSTS.

GRAAFIAN FOLLICLE CYSTS—CORPUS LUTEUM CYSTS.

Cystic Graafian follicles form tumors of the ovary which are merely enlargements of structures that normally rupture and disappear. The cysts may be single or multiple and vary from 0.5 to 6 or 8 cm. in diameter. The smaller cysts are not pathologic unless they occur in large numbers in the hypertrophied ovary. Where there are multiple cystic follicles the individual cysts seldom exceed 1 or 1.5 cm. in diameter and the entire ovary forms an ovoid tumor averaging about the size of a walnut.

Single cysts may increase to the size of an orange or even to the size of an infant's head. As a rule, however, they are from 3 to 5 cm. in diameter. The cysts are smooth, globular, and elastic, have thin transparent walls, and clear serous contents. They may be situated at one pole of the ovary or may occupy practically the whole

¹ Prüssmann, F.: "Tuberculosis of Ovarian Tumors," Arch. f. Gyn., 1905, Bd. lxxviii, p. 113.

organ, only a small portion near the base being preserved. Histologically, the thinnest portions of the walls consist of fibrillated tissue poor in cells; the thicker portions near the pedicle contain normal ovarian structures. A layer of flattened cells may sometimes be seen lining the inner surface.

Corpus luteum cysts develop when the follicle matures and hemorrhage takes place, but rupture and the normal involution do not occur. The average size of the cyst is that of a walnut. They are of a brownish or bluish-red color, sometimes slightly yellowish, and their walls vary from 1 to 3 mm. in thickness. The inner surface is covered with a friable fibrinous membrane, and the cavity contains disintegrated blood. Histologically, the cyst walls consist of ovarian stroma which has become compressed and thinned out over the most prominent portion of the cyst. The thicker portions contain normal follicles and ova. The interior of the cyst is usually lined with a thin fibrous membrane, probably derived from the *membrana propria*, and beneath this there is a more or less definite zone of lutein cells. The lutein cells, however, may form the innermost lining of the cyst.

Calcification of the lutein hematoma results in the formation of the so-called ovarian stone, which consists of a hard calcareous shell surrounding the shrunken blood-clot.

New Growths of the Ovary.

—In its topographic relations the ovary consists of two portions,—an intraperitoneal portion devoid of serous covering, and a small sub-

serous portion at the hilus. Proliferating ovarian tumors generally occupy practically the entire organ, and, therefore, only a small portion of the surface of the tumor is covered with a serous membrane. Occasionally the tumor develops only in the intraperitoneal portion, and is then entirely lacking in a serous coat; while in other instances, again, the development is chiefly toward the hilus, between the folds of the mesosalpinx and the broad ligament, and the tumor is then covered on all sides with peritoneum. A pseudo-intraligamentary tumor is formed when a small tumor lies back in the pelvis and in its development draws the broad ligament out over its anterior and superior surfaces. Adhesions then form between the two surfaces and the tumor simulates a true intraligamentary growth.

Pedicle.—Ovarian tumors are attached to the broad ligament by the same



FIG. 122.—HEMORRHAGIC CORPUS LUTEUM CYST (C) AND CYSTIC GRAAFIAN FOLLICLE (G) IN THE SAME OVARY. (After H. A. Kelly.)

structures by which the normal ovary is attached, but the relations of these structures may be greatly altered by the development of the tumor. The normal relations are best preserved when the tumor develops entirely in the intraperitoneal portion of the ovary, and as the tumor ascends into the abdomen the mesovarium and utero-ovarian ligament become drawn out into a narrow pedicle. Where the tumor is partly subperitoneal the folds of the mesosalpinx are more or less separated, sometimes only in its outer portion, but again all the way to the uterine cornu; and the tube is flattened out over the surface of the tumor. In some instances the uterus is also closely attached to the tumor and is drawn up with it into the abdominal cavity. In the case of intraligamentary tumors the folds of the broad ligament are opened up and the pelvic peritoneum, sometimes even the abdominal peritoneum, is lifted up over the tumor.

Torsion of the pedicle is a common accident in the natural history of ovarian tumors. It is most frequent in cysts of medium size, and is especially frequent in dermoids. The chief causes of the accident seem to be the increased intestinal peristalsis, violent movement causing increased contraction of the abdominal walls, etc. The twist is usually toward the median line, and may consist only of a partial revolution or of several revolutions of the pedicle. The effect produced upon the pathologic anatomy of the tumor depends upon the extent of the torsion and the degree of strangulation of the vessels. There may be merely a moderate degree of passive congestion, with slight hemorrhages which are soon absorbed, or there may be a sudden severe fatal hemorrhage. The tumor is usually of a dark mahogany or blackish-blue color, and covered with fibrinous adhesions. The interior, in the case of cystic tumors, shows the cyst cavities filled with chocolate-colored fluid and the walls hemorrhagic and friable. Solid tumors show advanced hemorrhagic necrosis.

Classification of Ovarian Tumors.—The old division of ovarian tumors into solid and cystic tumors was not founded upon a scientific basis and was confusing clinically, while the further clinical classification into benign and malignant tumors was also misleading, as many of the multilocular cystic tumors which were classed as innocent tumors, were found on histologic examination to be malignant. The rational classification according to the histogenesis was first introduced by Waldeyer, who divided the tumors into those of epithelial origin and those of connective-tissue origin. More recently Pfannenstiel,¹ as a result of careful investigation into the histogenesis of ovarian tumors, especially regarding the observations of Marchand, Bonnet, Wilms, and others relating to the origin of dermoids and teratomata, has divided the epithelial tumors into two groups according as they arise from germinal epithelium or from the follicular epithelium, and together with those developing from the ovum, classifies them under the heading *parenchymatogenous tumors* in contradistinction to the *stromatogenous* or connective-tissue tumors. The presence of aberrant portions of Müller's ducts in the ovary, associated with cystic carcinoma of the opposite ovary, as described by W.

¹ Pfannenstiel: "Die Erkrankungen des Ovarium," Veit's Handbuch.

W. Russell,¹ suggests another source for the development of some epithelial tumors of the ovary. The classification of Pfannenstiel, with some modifications, will be adopted in this work.

PARENCHYMATOGENOUS TUMORS.

EPITHELIAL TUMORS.

Epithelial tumors may be divided into two main groups, depending upon the character and mode of growth of the cells: (1) Benign tumors, or cystadenomata,

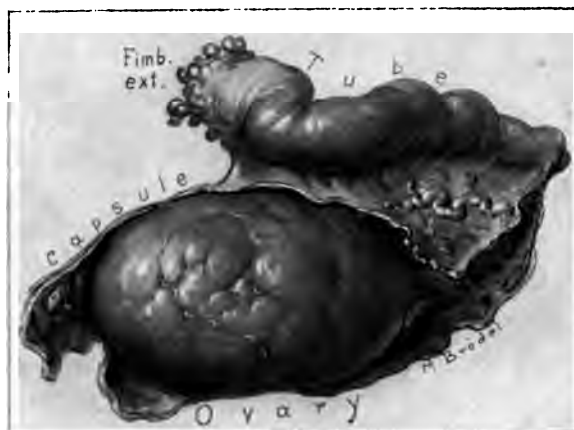


FIG. 123.—OVARY PARTLY SURROUNDED BY THICK FIBROUS CAPSULE. (After W. W. Russell.)

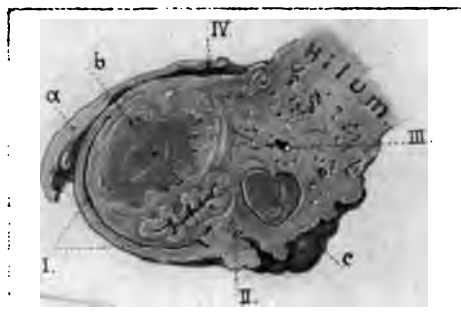


FIG. 124.—LONGITUDINAL SECTION THROUGH THE OVARY SHOWING THE CAPSULE (a), A CORPUS LUTEUM (b), A SMALL HEMATOMA (c), IRREGULAR SPACES I, II, AND III. (After W. W. Russell.)

and (2) malignant tumors, or carcinomata. The cystadenomata may be again divided into two groups, distinguished morphologically by the formation of multiple simple cysts—cystadenomata; or, by the formation of cysts with intracystic and superficial papillary growths—papillary cystadenomata. Gebhard points out the analogy existing between the morphology of the ovarian adenomata and uterine carcinomata and classifies them under the headings of cystadenoma evertens and invertens. Pfannenstiel, again, as the result of his observations regarding

¹ Russell, W. W.: "Aberrant Portion of the Müllerian Duct found in an Ovary," Johns Hopkins Hospital Bull., 1899, vol. x, p. 8.

the cell secretion, divides the ovarian cysts into cystadenoma pseudomucinosum, and cystadenoma serosum, the pseudomucinous cysts including practically all the simple multilocular cysts, and the serous cysts corresponding, with few exceptions, to the papillary cysts.

Cystadenomata owe their origin to the multiplication of some epithelial elements in the ovary, it may be from the lining of the Graafian follicles, as Pfannenstiel, Gebhard, and others believe, or from germinal epithelial rests, as claimed by Walthard, or from Müllerian structures, but this point is not definitely settled. The tumors vary greatly in size, some being smaller than an orange, others weighing from one to two hundred pounds. Large tumors, which were frequently

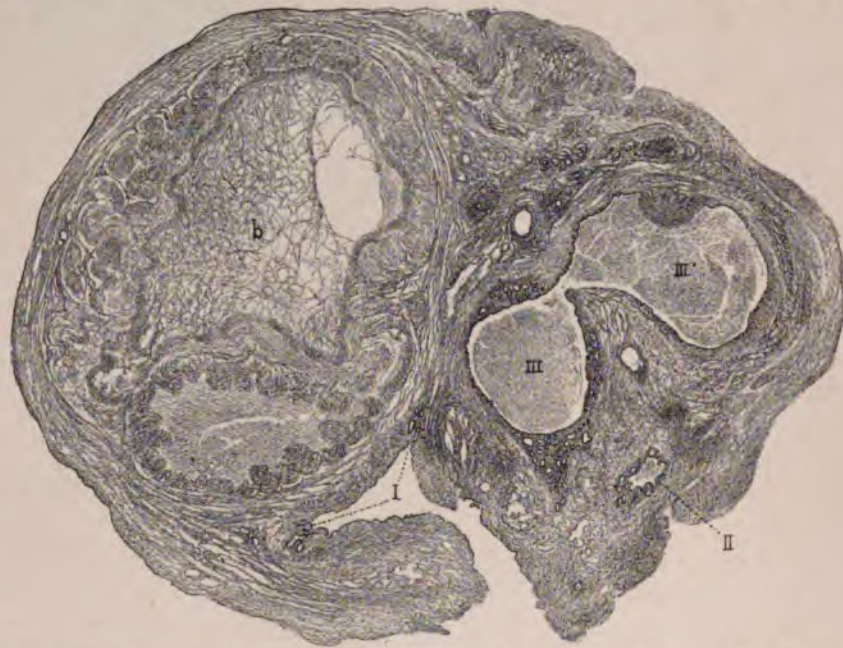


FIG. 125.—SECTION THROUGH THE PRECEDING SPECIMEN (X 4) SHOWING THE GLANDULAR TISSUE LINING THE SPACES (I, II, AND III) AND THE CORPUS LUTEUM (b). (After W. W. Russell.)

reported in former times, are now rarely seen, because all tumors are removed early. The tumor appears as a round or oval mass with a smooth, glistening, pearly-gray surface, sometimes regular in contour, sometimes presenting irregular bosses, or divided into distinct lobules. The vascularity may be poor or may be very good. In the subserous tumor, especially, very large blood-vessels may spread out from the pedicle over the surface of the growth. Large areas of hemorrhage are frequently formed in the cyst walls and sometimes the cyst contents are discolored with old blood. The tumor is more or less distinctly fluctuant, but this quality depends upon the size and arrangement of the individual locules. There are generally one or two large cavities with smaller secondary cysts in their walls, and forming projecting masses into the main cysts (Fig. 123). In some instances a large part of the tumor-mass

is composed of a fine honeycombed meshwork of glands and minute cysts. Such an area, especially when the glands contain a thick opaque material, may at first

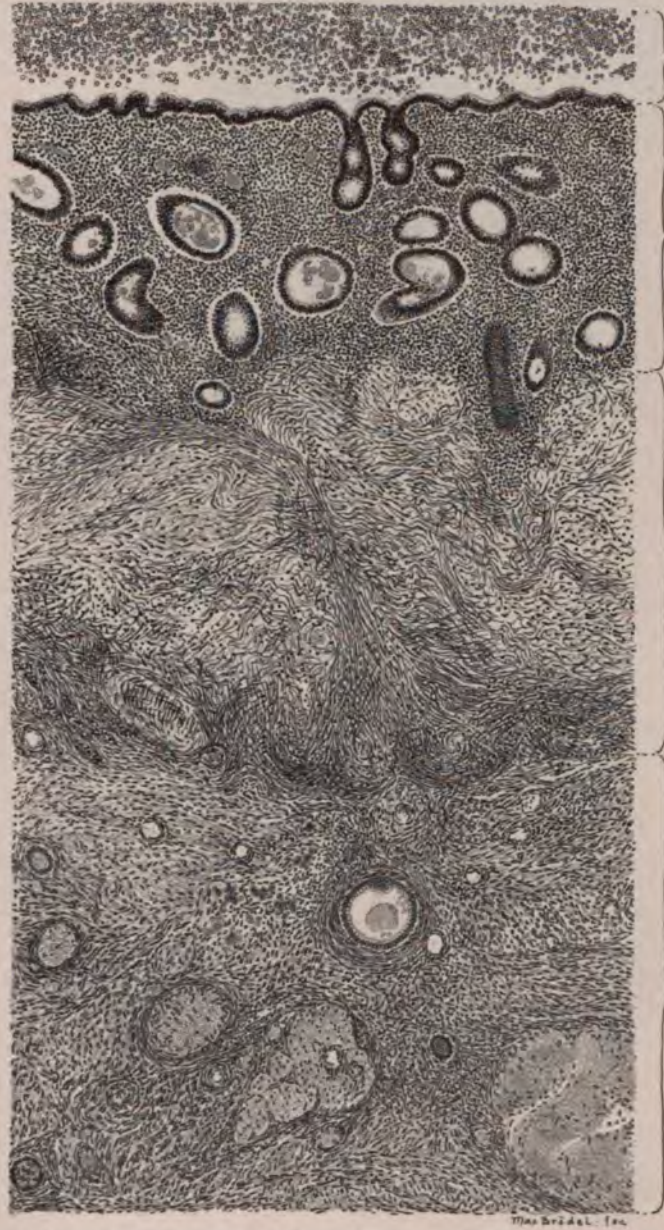


FIG. 126.—A HIGHER MAGNIFICATION OF A SMALL PORTION OF THE WALL OF III, FIG. 124. ($\times 70$.) Showing the inner surface covered with free blood and lined with a mucous membrane, the prototype of the endometrium. This is separated from the normal ovarian tissue by a band of smooth muscle. (After W. W. Russell.)

sight suggest a solid tumor formation and a malignant process in the cyst wall may be suspected. When, however, the contents are carefully expressed the regular arrangement and thin smooth septa of a simple cystadenoma are discovered.

The cyst walls are from 2 to 6 mm. thick and consist of firm fibrous tissue. Frequently large, dense, fibrous plaques are found on the outer surface and sometimes large calcified areas. In somewhat rare instances a portion of the tumor wall may be 5 to 7 cm. thick, consisting of dense fibrous tissue. It would appear



FIG. 127.—MULTILOCULAR OVARIAN CYST, IN WHICH THE SMALLER CYSTS PROJECT INTO THE CAVITY OF THE LARGE ONE, WHICH IN THIS WAY PRESENTS EXTERNALLY THE APPEARANCE OF A MONOCYSTIC TUMOR.

The utero-ovarian ligament and the uterine tube are seen cut across below. $\frac{2}{3}$ natural size. (After H. A. Kelly.)

as if in these cases there were two distinct processes, an epithelial and a connective-tissue proliferation, and they are classified by some writers as mixed tumors. The intercystic septa are delicate and transparent and usually less than 1 mm. in thickness, while the inner surfaces of both the large and the small cysts are smooth and glistening. They are sometimes studded with minute granular elevations,

but definite papillary ingrowths are rare in this variety of tumor. There is often a fine crystalline deposit over the inner surface, also pigmented areas resulting from slight hemorrhages.

Histology.—The cyst walls consist of fibrous tissue arranged in two or three parallel layers. The outer layers are usually very poor in cellular elements, but toward the inner surface they contain fairly abundant oval or fusiform cells and in places resemble normal ovarian stroma. The intercystic septa also consist

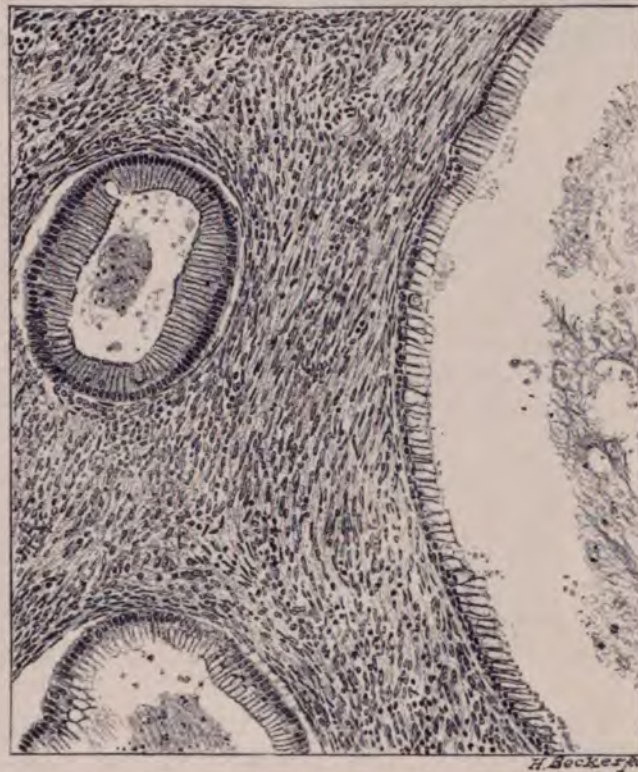


FIG. 128.—THE WALL OF A CYSTADENOMA OF THE OVARY. (170 diameters.)

In the large space on the right and in the lower of the two small spaces the epithelial cells show various stages of activity; some are granular, have oval nuclei, and contain no pseudomucin, others are partly transparent, while others again are typical goblet-cells, the cell body distended with the transparent secretion and the nucleus flattened at the base of the cell. The stroma consists of cellular fibrous tissue, slightly infiltrated with small round cells. (After H. A. Kelly.)

of somewhat cellular tissue. Normal ovarian elements,—young follicles, corpora lutea, or fibrous bodies,—are frequently found in the cyst wall, especially in the vicinity of the hilus. The lining membrane is characteristic, being composed of a single layer of high cylindric epithelium having basal nuclei and clear cytoplasm, while typical goblet-cells are often abundant. Implantations upon the omentum and abdominal peritoneum are occasionally found with the cystadenomata. They appear as aggregations of small, glistening, transparent cysts varying from a pinhead to 5 or 6 mm. in size. These growths are not malignant and

may disappear after removal of the primary tumor. The rupture of the pseudomucinous cysts gives rise to the peculiar condition of the peritoneum known as pseudomyxoma, which is characterized by the formation of masses of transparent cysts consisting of the encysted gelatinous exudate.

Papilocystadenoma (*cystadenoma invertens*, *cystadenopapilloma serosum*).—These cysts have on their inner surface, sometimes also on the peritoneal surface, papillary excrescences which may be small warty elevations or large masses of branching papillary ingrowths, which practically obliterate the cyst cavity. The papillary growths in the interior of the cysts may break through the wall and appear on the peritoneal surface of the tumor, or primary papillary masses may develop in this region. Inoculation growths upon the omentum and general peritoneum are very frequent. These growths may disappear spontaneously after removal of the primary lesion, but often remain and pursue a semimalignant course, accompanied by an excessive accumulation of ascitic fluid. Distant metastases occasionally develop, but are rare.

The epithelium in these cysts is sometimes high cylindric, with goblet-cells, and the cyst contents are pseudomucinous; but much more frequently the epithelium consists of columnar or cuboid cells, with granular protoplasm which stains well and uniformly with eosin, and oval nuclei situated near the center of the cell. The cells are often ciliated. Many nuclei, often very large and deeply staining. The contents of the cysts are serous in character. The stroma of the main wall of the cyst is dense and fibrous; in the papillary ingrowths it consists of a loose tissue, generally poor in nuclei and very slightly fibrillated, the wide meshes containing a homogeneous eosin-stained substance resembling serum. **Carcinomatous** changes in the wall may sometimes be detected, but often it is impossible to determine from the pathologic anatomy whether the tumor is benign or malignant. Sarcoma in the wall of a cyst has also been observed (Cullen¹).

Carcinoma of the Ovary.—Carcinoma of the ovary comprises about 15 per cent. of all ovarian tumors. It is often bilateral. Glockner,² examining a large number of cases, found that macroscopic tumors were present in both ovaries in 29 per cent., and that in a further 17 per cent. microscopic evidence of cancer was found in the apparently normal ovary, making 46 per cent. in which the disease was bilateral. This investigation emphasizes the generally recognized danger of leaving the apparently normal ovary *in situ* in case of operation for ovarian cancer. Morphologically two fairly well-defined groups of ovarian carcinoma may be distinguished—the solid tumor and the cystic tumor—but there are many intermediate forms.

The *solid ovarian carcinomata* are the least numerous, forming probably about 10 per cent. of the cases. They may be further subdivided into two types of tumors

¹ Cullen, T. S.: Am. Journal of Obst., vol. xxxiv, No. 3, 1896.

² Glockner, A.: "Beiträge zur Kenntniss der soliden ovarian Tumoren," Arch. f. Gyn., 1905, Bd. lxxv, H. 1.

distinguished by the relative proportions of the epithelial and connective-tissue structures and by the size of the individual epithelial nests,—the medullary carcinoma characterized by its soft consistency and the formation of large alveoli, separated by thin strands of fibrous-tissue stroma, and the scirrhus tumor, which is dense and fibrous and sometimes difficult to differentiate in the gross specimen, from a cellular fibroma. The latter variety forms the majority of the definitely solid growths, as the medullary tumors are more liable to present large areas of degeneration, and therefore are often partly cystic. The solid carcinomata seldom form large tumors, averaging from the size of the closed fist to about the size of an



FIG. 129.—PAPILLOCYSTADENOMA OF THE OVARY, WITH PAPILLOMATOUS MASSES WITHIN THE CYSTS AS WELL AS ON THE SURFACE.

Patient well after twelve years. Both ovaries were involved. Natural size. (After Cullen.)

infant's head. In some cases the tumor resembles the enlarged normal ovary; others are round, ovoid, or kidney-shaped. In one case, personally observed, the tumor was in the form of a disc about 12 cm. in diameter and 4 cm. thick. In my experience practically all cases of scirrhus carcinoma of the ovary have been bilateral. It has been noted by several observers that double scirrhus ovarian carcinomata are often, if not always, metastatic tumors, the primary growth usually being situated in the uterus, stomach, breast, intestine, or gall-bladder. This has been especially emphasized by William H. Welch.

The surface of the tumor is of a grayish-pink color, is generally smooth, and exhibits little tendency to contract adhesions. The tumor develops in the paren-

chymatous intraperitoneal portion of the ovary and therefore has a definite pedicle corresponding to the pedicle of the normal ovary. On section of the tumor the cut surface shows large or small homogeneous or finely granular areas surrounded

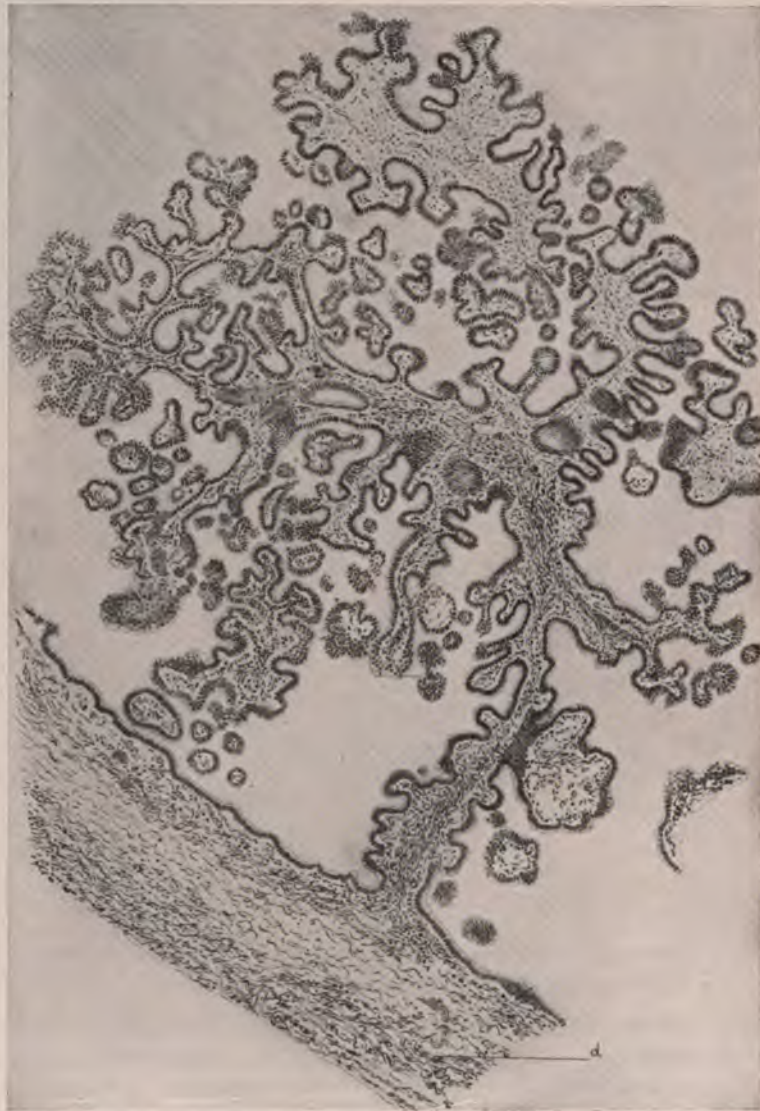


FIG. 130.—A SECTION OF A PAPILLARY EXCRESCENCE FROM THE TUMOR SHOWN IN FIG. 129.

The cyst wall (d) and the delicate stalk of the papillary mass consist of fairly dense fibrous tissue, but the terminal branches have a loose edematous stroma. The epithelium covering the outgrowth and lining the cyst wall consists of a single layer of columnar cells. (After Cullen.)

by the fibrillated stroma. Yellowish foci of degeneration are frequently noticed in the softer tumors. In the scirrhous tumors, as has been said, the differentiation from a cellular fibroma is often difficult and in some instances can be determined

only by the microscopic examination. The chief points of differentiation are the darker gray color, lesser density, and, on careful examination of the fresh specimen, fine homogeneous dots and strands may be seen embedded in the fibrillated stroma.

Cystic carcinomata may develop in two ways: The cystic spaces may be the result of degenerative changes in a solid tumor, or they may be an essential char-

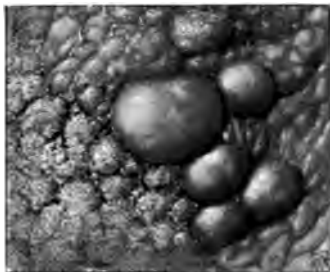


FIG. 131.—SARCOMATOUS NODULES IN THE WALL OF A PAPILLOCYSTADENOMA OF THE OVARY. The smooth, rounded, sarcomatous nodules are readily differentiated from the surrounding fine papillary excrescences of the cyst wall. (After Cullen.)



FIG. 132.—CARCINOMA OF BOTH OVARIES AND MYOMA OF THE UTERUS. ($\frac{1}{3}$ natural size.)

The small carcinomatous nodules are quite superficial and on the right side the ovarian substance is not invaded. The left contains a small cancerous focus. The ovarian tumors were associated with carcinoma of the omentum, but no other focus could be discovered. (Johns Hopkins Hospital.)

acteristic of the tumor and produced by the accumulation of fluid secreted by the epithelial lining of the alveoli. Secondary carcinomata developing in an ordinarily benign cyst are not included in the above groups but will be considered later. These tumors often attain a large size, sometimes filling the abdomen. They are usually spherical or slightly lobulated. Their surface is grayish, sometimes showing yellowish areas of degeneration, and frequently broad adhesions. The mass is

indistinctly fluctuant, and it may comprise one large cyst with very thick walls, with a solid tumor-mass at the base, or it may consist of several irregular cystic spaces embedded in solid tumor substance. In general, the solid portion is exceedingly soft and friable. It may, however, be rather dense. The lining of the cyst may be quite smooth or may be covered with fine papillary elevations; it is sometimes shaggy and necrotic, and is often discolored by old hemorrhages. The cyst contents are serous, sometimes hemorrhagic, pseudomucinous, or, owing to a large



FIG. 133.—CARCINOMA OF THE OMENTUM SECONDARY TO CARCINOMA OF THE OVARY. ($\frac{2}{3}$ natural size.)

The normal omentum is shown above. The tumor mass occupying the free border of the omentum consists of solid carcinomatous tissue and transparent peritoneal cysts apparently of inflammatory origin. (Same case as Fig. 132.)

amount of degenerated desquamated epithelium, may resemble thick, creamy pus. The semisolid and solid portions of the tumor show the large and small alveoli situated in a more or less abundant fibrous stroma. These tumors are usually exceedingly friable and on removal are apt to tear, when, on account of their vascularity, profuse hemorrhage may occur.

Histology.—The microscopic picture of ovarian carcinoma varies considerably. In general, the epithelial cells occur in solid clumps and cords, and a

purely glandular type is comparatively rare. In some cases the alveolar arrangement of the epithelium is very indefinite and the impression given on the examination of some sections may be that of sarcoma, while further sections from the same tumor show an alveolar structure and cells which are clearly epithelial. In the hard tumor fine strands of epithelium, often apparently a single or double row of cells, are seen running in all directions throughout the densely fibrillated, rather cellular stroma. Here and there a cross-section of a little circle of cylindric cells, surrounding a minute lumen, suggests a glandular structure. Large clumps of



FIG. 134.—CYSTIC CARCINOMA OF THE OVARY.

Bisection of the tumor in its long axis showing the gross appearance of the fresh specimen. The solid portion of the tumor, which forms the thick wall of the central cyst, shows a distinctly alveolar structure consisting of light, yellowish-gray, homogeneous areas (a) embedded in a fibrillated stroma. The central cyst (b) is lined with a distinct membrane, the inner surface being discolored with old hemorrhages. The smaller cysts (c), embedded in the solid substance of the tumor, contain clear gelatinous or hemorrhagic material.

cells are sometimes seen near the periphery of the tumor. The glandular carcinomata usually show large and small alveoli lined with one or several layers of epithelium, which in places obliterates the lumina, and again may form papillary growths. In a somewhat rare variety of tumors the gland spaces are strikingly similar to normal Graafian follicles, and the whole tumor may appear to be made up of myriads of slightly dilated normal follicles. A number of the glands may contain large degenerating cells in the center which are readily mistaken for ova. In another variety of glandular carcinoma the microscopic picture in places resembles the thyroid gland, while in other areas a rapid multiplication of the

epithelial cells is evident. In such instances, however, the cancer may be a secondary process in one of the so-called thyroid tumors of the ovary (*struma ovarii*), tumors which are now generally regarded as *embryomata*, in which the ectodermal elements have developed, almost to the exclusion of the other germinal layers.

The epithelium itself is also very varied, both in type and in the individual cell-elements. In the cystic and glandular tumors the cells are low columnar, cuboid, or polymorphous, and have large vesicular nuclei. They are often hydropic and may appear as large transparent vesicles with a crescentic nucleus pressed to one side. When they form solid masses the cells are spherical or polymorphous, usu-



FIG. 135.—CARCINOMA OF THE OVARY. ($\frac{2}{3}$ natural size.)

The figure shows the tumor of the left ovary from a case of bilateral ovarian carcinoma. The tumor is dense and solid; the surface somewhat nodular, but free from adhesions. (Johns Hopkins Hospital.)

ally the latter. The nuclei are often intensely and solidly stained. Mitotic figures are numerous.

Colloid carcinoma of the ovary is somewhat rare. It is a large semisolid tumor, consisting of irregular cystic spaces filled with translucent gelatinous material, and a solid portion, which consists of a fibrous meshwork infiltrated with the colloid material. The surface of the tumor usually presents mulberry-like masses of the translucent colloid growth, and omental metastases are often found. Microscopically, the tumor shows large and small alveoli filled with tenacious colloid material and lined with cylindric epithelium in the various stages of colloid degeneration. Colloid material also infiltrates the surrounding stroma.

Ovarian Embryomata (Dermoid Cysts and Teratomata).—*Dermoid Cysts.*—Simple dermoid cysts of the ovary are exceedingly rare, if they ever occur. The

so-called dermoid of the ovary usually contains all three germinal layers, and it is now generally accepted that there is no real anatomic difference between the dermoid cyst and the solid teratoid growths of this organ. The various theories that have been advanced from time to time to explain the origin and development of these tumors cannot be discussed within the limits of this work. Since the investigations of Wilms, Marchand, and Bonnet, however, it is generally accepted that the tumors are embryonal, but whether they originate from fertilized polar bodies or from ectopic blastomeres, or from some other source, has not been determined.

The embryomata, having a congenital origin, may appear in intrauterine life



FIG. 136.—ADENOCARCINOMA (COLLOID CARCINOMA) OF THE OVARY, WITH NUMEROUS CARCINOMATOUS NODULES ON THE EXTERNAL SURFACE OF THE UNRUPTURED CYSTS; SECONDARY GROWTHS IN THE OMENTUM. ($\frac{1}{3}$ natural size.) (After H. A. Kelly.)

or may develop in old age. They are most frequently discovered in adolescence and early adult life, and have often been observed to develop rapidly after puberty. They may be unilateral or bilateral, and are usually pedunculate, rarely intraligamentary. Portions of the tumor parenchyma may become transplanted to other parts of the abdominal cavity and develop there; or the primary tumor, through torsion and separation of its pedicle, may become parasitic. Several writers have noted the combination of embryoma with cystadenoma. In one case I found a small dermoid cyst near the ovary which was the seat of an ordinary scirrhous carcinoma, the opposite ovary being also carcinomatous. The dermoid, which was only 1 cm. in diameter, was entirely separated from the carcinomatous growth

by normal tissue; but, of course, the possibility of the cancer being a secondary growth could not be positively excluded.

Gross Appearance.—Benign ovarian embryomata on the average are about the size of an infant's head or slightly smaller, but they may be either very large or of microscopic size. They are usually spherical, have a smooth surface, or show irregular elevations, and are often covered with dense adhesions. They are of a pearl-gray or yellowish-white color, are resilient while *in situ*, and usually present irregular, dense or hard areas, while dark hairs are frequently seen through the transparent walls. Very shortly after removal the elastic quality of the tumor gives place to a characteristic doughy consistency. The tumor, probably on account of its medium size and peculiar consistency, is often observed to lie anterior to the uterus, and torsion of the pedicle is also peculiarly common. The tumor contains single or multiple cysts, which have clear buttery, or cheesy, contents intermingled with numerous short or long hairs. Hairs are also attached to the cyst wall, often to solid elevations. Teeth, bone, etc., are sometimes found. In the wall of the main cyst there may be clusters of small vesicles of irregular size and shape. The combination with cystadenoma has been noted above. In some cases the tumor is largely solid, consisting of plates of bone and cartilage, fat, fibrous and muscular tissue, etc.

Histology.—The large cysts are usually lined, at least in part, with stratified squamous epithelium. The underlying tissue presents a complicated structure and contains smooth muscle, fat, cartilage, and bone, central nervous system, glands of the skin, mucous and serous glands, intestinal and other abdominal structures. The cells are of the adult type, but the organs rudimentary. The presence of giant-cells, by some writers regarded as foreign-body giant cells, has frequently been noted; their distribution, sometimes lining the groups of small transparent vesicles in the wall of the main cyst—it may be in a continuous layer or only here and there,—at other times embedded in the deeper tissues, speaks against a foreign-body origin. In a very small embryoma these giant cells are sometimes the most characteristic feature.

Teratomata are solid embryomata and are malignant. They are comparatively rare. These tumors are also, as a rule, composed of all three germinal layers, but the cells, instead of being of the adult type as in the so-called dermoid tumors, are embryonic; and instead of forming rudimentary fetal parts in a fairly regular manner, the tissues corresponding to the different germinal layers have no special arrangement but form a complicated mass. The teratoid growths are large tumors, often nodular, and are characterized by their irregular consistency, and the presence of ectopic embryonal tissues.

Histology.—Epithelial and connective-tissue structures similar to those found in the simple embryomata are seen, but the atypical character of the cells and their disorderly proliferation indicate the malignant nature of the tumor. The occurrence of trophoblast, Langhans', and syncytial cells in ovarian embryomata has recently been pointed out by Pick and Landau, who believe that this form of growth is characteristic of the malignant tumors of the ovary in early life.

Struma ovariana (thyroid tumor of the ovary) is an embryoma of the ovary which in its structure is the prototype of the normal thyroid gland. It is an embryoma in which apparently one germinal layer has developed almost to the exclusion of the other layers. Malignant changes in these tumors are frequent.

STROMATOGENOUS TUMORS.

FIBROMA AND SARCOMA.

The tumors originating in the connective-tissue stroma of the ovary may be divided into two groups—the benign tumors, or fibromata and fibromyomata, and malignant tumors or sarcomata.

Fibroma of the ovary is comparatively rare, forming a little over 2 per cent. of all ovarian tumors. It is most frequent in middle life and is very rare under the age of twenty-five. I have, however, seen a large fibroma in a girl of seventeen years. It is always unilateral, the left ovary being apparently the most frequently affected. The tumor develops in the intraperitoneal portion of the ovary and is therefore pedunculate and not covered with peritoneum. Sometimes the tumor develops in the lateral part of the ovary and a portion of the ovary is preserved at the base of the mass. This contains the normal elements, but, according to Glockner, shows chronic inflammatory changes. The pedicle is usually thin, and in some instances the mass has separated entirely from its usual attachment and has become adherent to the peritoneum from which it receives its nourishment. In one such case, operation was abandoned because the large tumor, densely adherent to the posterior abdominal wall and quite free from the pelvic organs, was supposed to be an inoperable retroperitoneal sarcoma, but it was, however, successfully removed by G. L. Hunner a year or two later. The tumors vary from the size of a closed fist to the size of an adult's head. They often resemble the normal ovary or the kidney in shape, are exceedingly hard, and have a smooth, dense white surface with few blood-vessels visible. Occasionally the surface is irregular and studded with small knob-like elevations. The cut surface is white, glistening, and fibrillated. The tumor may present areas of edematous and cystic degeneration, in which case it is softened, more vascular, slightly translucent, and of a pinkish-gray color, the macroscopic picture slightly suggesting a malignant growth. Hyaline changes may produce dense yellowish areas.



FIG. 137.—FIBROMA OF THE OVARY. (Natural size.)

Histologically, the tumor presents a generally uniform appearance. It is composed of interlacing fibers and more or less abundant spindle-shaped or fusiform cells having long, slender, spindle-shaped, fusiform, or star-shaped nuclei.

The nuclei are uniform in size and staining properties, and do not show active division. The blood-vessels are few, usually small, and have well-formed walls. Some fibromata are rather richly cellular, the cells large, fusiform, and well stained, and the differentiation from sarcoma may be difficult. The chief points in favor of a benign tumor are the uniformity of the cells, with absence of mitotic figures and of newly formed blood-vessels, but the gross appearance of the tumor and the clinical history may be necessary aids in making the diagnosis. Small superficial fibromata of the ovary are frequently observed, but as they remain small and give rise to no symptoms they are of no practical importance.

Solid fibropapilloma is a very rare variety of ovarian tumor. In the examination of about 550 ovarian tumors I have come across only one example. This was a small hard tumor about the size of an egg. Its surface was distinctly lobulate and



FIG. 138.—SARCOMA OF THE OVARY WITH HEMORRHAGIC CYSTIC AREAS. ($\frac{1}{10}$ natural size.) (After Russell and Schenck.)

sections showed a solid fibrous tumor divided into lobules, which were sometimes separated by narrow grooves. Sections microscopically examined showed the characteristic structure of a fibroma fairly regularly divided in a mosaic-like pattern by double rows of epithelium with narrow spaces between. No trace of ovarian structure remained.

Myoma of the ovary is occasionally described. Basso¹ reported 4 cases and collected 45 cases from the literature. They occur at any age, but are most frequent between twenty and thirty-six years. The tumors in their macroscopic and microscopic appearance are identical with the uterine myomata.

Sarcoma of the Ovary.—The sarcomata of the ovary, like the fibromata, are somewhat rare tumors, comprising about 5 per cent. of all ovarian tumors and

¹ Basso: "Beit. z. Kennt. der gutartig. Neubild. des Ovariums, etc.," Arch. f. Gyn., 1904, Bd. lxxiv, S. 70.

about 14 per cent. (Russell) of the malignant tumors. Out of 550 ovarian tumors observed in Kelly's clinic there were 28 cases of sarcoma. Pfannenstiel found 5.38 per cent. in a series of 400 ovarian tumors. Sarcoma occurs at all ages and has been found in the fetus (Doran). The greatest number of cases are found in early adult life, but the disease is relatively frequent in young children, forming about 50 per cent. of the ovarian tumors in children under five years. Five out of Glockner's seven cases were in the fifth or sixth decade. The tumors vary greatly in size. They may equal a small orange, may be as large as a man's head, or may even



FIG. 139.—SECTION FROM FIG. 138 ($\times 120$), SHOWING THE INVASIVE CHARACTER OF THE GROWTH, AND THE LYMPH CHANNELS IN THE STROMA FILLED WITH ROUND TUMOR CELLS. (After Russell and Schenck.)

fill the entire abdomen up to the costal margin. The surface is generally smooth and even; it may be lobulate. The consistency is generally soft, although the fibrosarcomata may be somewhat resistant. Cystic degeneration is almost invariably found and may involve the greater part of the tumor, leaving only a soft friable wall which tears with the slightest handling. Hemorrhage into the degenerate areas is common. On section the cut surface presents a soft, grayish, homogeneous, brain-like substance which is exceedingly vascular; in the fibrosarcomata the tissue is slightly fibrillated. The tumor is usually attached by a long pedicle, but

is sometimes intraligamentary, developing between the folds of the broad ligament and beneath the pelvic and abdominal peritoneum. Adhesions to neighboring structures frequently form. According to most statistics, both ovaries are affected in about 11 per cent. of the cases. Only one of Glockner's 8 cases was bilateral, as compared with 47 per cent. of the carcinomata.

Histologically.—The most frequent variety of sarcoma of the ovary in

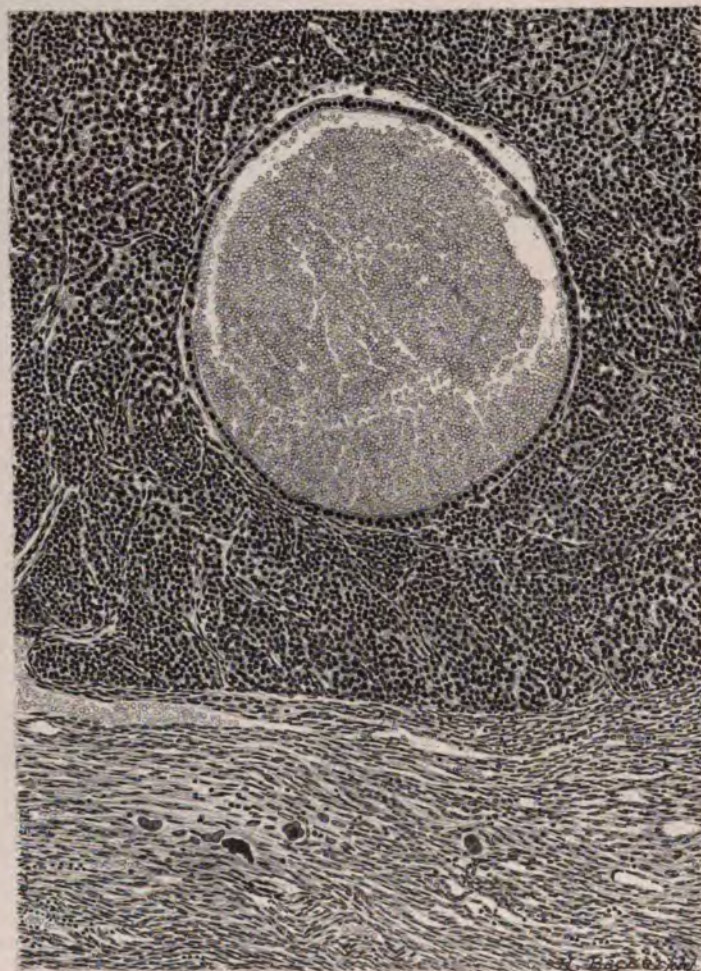


FIG. 140.—SECTION (X 200) SHOWING THE RELATION OF THE TUMOR CELLS TO A SMALL GRAAFIAN FOLLICLE.
(After Russell and Schenck.)

adults is the spindle-cell tumor, while in young children the tumors are almost exclusively of the small round-cell variety. Fibrosarcomata are also frequent in adults. Myxosarcoma and giant-cell tumors are exceedingly rare. The spindle-celled sarcomata are characterized by the presence of abundant spindle or fusiform cells and a large number of newly formed blood-vessels, the walls of which often appear to be formed of the tumor cells. The cells are usually closely packed, but

are irregularly distributed. The cell nuclei are fusiform or oval, and are usually irregular in size and staining properties; karyokinetic figures are numerous, and multiple nuclei are sometimes found. The tumor may closely resemble a cellular fibroma, but may usually be distinguished by the irregular distribution of cells, the irregular size and staining properties of the nuclei, and the abundant mitosis.

Round-cell sarcomata generally present a more uniform appearance than the spindle-cell tumors. They are composed of closely packed round or oval cells, with well-stained round or oval nuclei, many of which contain nuclear figures. Capillary blood-vessels course in all directions between the tumor cells, and large, dilated veins are usually noticed.

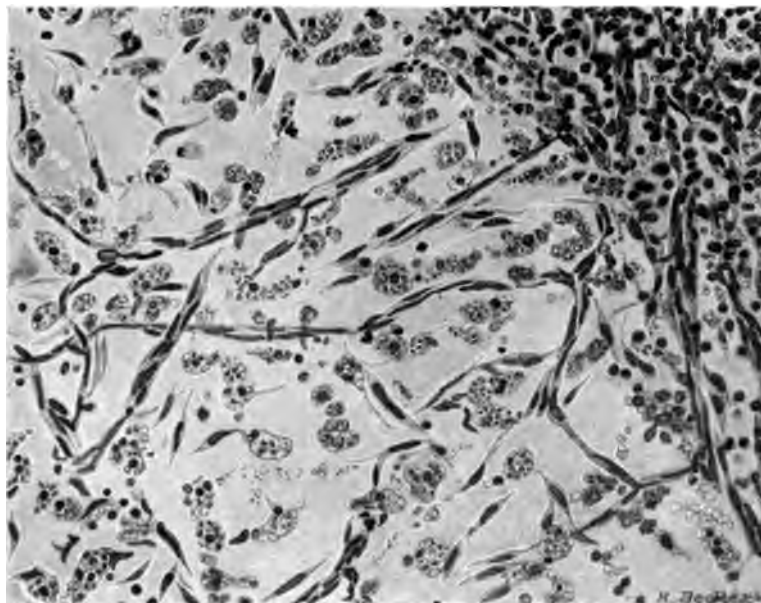


FIG. 141.—A SECTION FROM THE SAME CASE AS THE PRECEDING FIGURES. (X 300.)
Showing the margin of an organizing blood-clot. (After Russell and Schenck.)

Giant-cell sarcomata are exceedingly rare and I have seen only one case in which the giant cells were so conspicuous as to essentially characterize the tumor.

Endotheliomata of the ovary are frequently described and some writers, notably Pick, Hippel, and Borst, believe that a large proportion of malignant ovarian tumors belong to this group. Others, especially Ribbert, consider them to be rare. As pointed out by Glockner, the tumors usually described as endotheliomata are so often morphologically identical with the metastatic carcinomata that the presence of a primary carcinoma in some other organ must be excluded in all cases before an endothelioma is diagnosed. The tumor originates in the endothelium of the blood- or lymph-vessels and is characterized in different stages by the formation of cell-strands, rosette and pearl-like nests and gland-

like spaces, and of diffuse sarcomatous tissue. The individual cells are distinguished from epithelial cancer cells, according to Gebhard, by their smaller size, more rounded shape, and relatively smaller amount of protoplasm.

Another tumor of indefinite pathologic position is one described by Glockner, Marchand, and Kruckenburg, as *fibrosarcoma, intracellular carcinomatosa*. The arrangement and relation of the tumor cells show a stromatogenous growth, but the cells themselves resemble epithelial cells and are often distended with mucus. Ribbert apparently classes these tumors with the carcinomata.

MIXED TUMORS OF THE OVARY.

There is an indefinite group of tumors which do not belong to the embryomata, but in which there appears to be an independent growth of both connective-tissue and epithelium. These tumors may be either benign or malignant. They include the fibroadenomata, the solid papillary fibromata described above, also the combination of dermoid with cystadenoma, or of dermoid with papilloma. The association of sarcoma with carcinoma, excepting in teratoid tumors, is exceedingly rare, if it ever occurs. The tendency of some tumors of a benign type to undergo malignant changes—for example, the occurrence of secondary carcinoma in the cystadenomata and dermoids, and of sarcoma in connection with epithelial tumors—may be regarded as forms of mixed tumor.

Degeneratio polycystica luteinalis is the term applied to a large ovarian tumor, which is made up of multiple cysts recognized as lutein cysts and due to the excessive hyperplasia of lutein cells. The tumor is usually found associated with hydatidiform mole or with chorioepithelioma and is often bilateral. It develops very rapidly by a process of multiple-cyst formation rather than by any enormous distention of a single cyst, the result being a tumor generally as large as a fetal head, consisting of a core of ovarian tissue and a peripheral zone of cysts (Lockyer¹). Of Lockyer's 4 cases, 3 were associated with chorioepithelioma, one with vesicular mole. In a case of chorioepithelioma observed in the gynecologic department of the Johns Hopkins Hospital both ovaries were transformed into polycystic tumors the size of two fists (Fig. 112). Histologically, the cysts are lined with a thinner or thicker layer of lutein cells, while solid groups of lutein-like cells are also found in the stroma. The cysts contain a pale albuminous fluid. The relation of these tumors to pathologic pregnancy is not clearly understood. Some writers believe that the ovarian tumor is the cause of the mole or the malignant degeneration of the chorion, while others consider that the ovarian degeneration is the secondary process, basing their opinion upon the fact that cystic disease of the chorion sometimes develops without the lutein hyperplasia, and also that the bilateral development of the ovarian disease indicates its consecutive formation. It is quite possible that the demand for increased lutein secretion to neutralize the trophoblastic excess excites the atypical lutein growth. Lockyer describes "a vast amount of discrete and compact lutein cells throughout the stroma" in apparently normal ovaries in a case

¹Lockyer: "Lutein Cysts, etc.," Jour. Obst. and Gyn., Brit. Empire, Feb. and Mar., 1905.

of vesicular mole and chorioepithelioma. Seitz and Wallart¹ maintain that excess of lutein tissue is found in all pregnancies and is due to the existence of the pregnancy. The true polycystic lutein tumor of the ovary is to be distinguished from the lutein-like changes found in normal ovaries in cases of normal pregnancy, as it is well recognized that various tissues in the ovary have a tendency to assume a lutein cell-like appearance (Frankel²). Normal and atretic follicles are often surrounded by a zone of epithelial-like or lutein-like cells, and if the follicle is slightly dilated it may resemble a lutein cyst.

Solid tumors developing from lutein-cells are of doubtful existence, and the few cases described as such were apparently instances of polycystic tumors containing a large amount of parenchymatous tissue. An unusual, semisolid tumor, which from its morphology appeared to have developed from the theca interna of the follicles, was described by Russell and Schenck.³ The tumor consisted of a large cystic sarcoma which showed extensive hemorrhagic infiltration resulting from torsion of the pedicle. On section it presented a solid portion and small cysts filled with blood. Histologically, the essential elements of the neoplasm consisted of small round cells arranged in distinct alveoli and in many places surrounding in a definite and regular manner well preserved or partly degenerated Graafian follicles. The character of the cells, especially the evidence of rapid proliferation, proved the malignant nature of the tumor.

PAROVARIAN CYSTS.

Parovarian cysts are produced by an accumulation of fluid in the parovarian tubules and develop between the folds of the broad ligament. They may attain a considerable size—equal to the size of a man's head or larger. The cysts are usually unilocular, and, according to Gebhard, when two or more locules are found they are the result of the distention of neighboring tubules. The cyst has a thin, transparent wall, and as it develops between the layers of the broad ligament it has a complete serous covering which often contains very large blood-vessels. The Fallopian tube is drawn out over the surface of the tumor, often encircling a half or more of its circumference, and the fimbriæ may extend several centimeters further. The ovary is practically unaltered, and is attached to the tumor by a short pedicle. The inner surface of the cyst is generally smooth, but here and there may be studded with little wart-like papillary elevations. The contents consist of a clear watery serous fluid.

Histologically, the cyst walls are composed of three layers,—a serous covering derived from the broad ligament, a middle layer consisting of fibrous tissue and a few scattered smooth muscle bundles, and an inner lining of cylindric, often ciliated, epithelium. The epithelial cells may vary in the same cyst, being cuboid

¹ Seitz and Wallart: "Luteinzellenwucherung, etc.," Zent. f. Gyn., 1905, Bd. xxix, S. 13.

² Frankel: "Lutein Cells," Cent. f. Gyn., Bd. xv, S. 503.

³ Russell and Schenck: "An Ovarian Sarcoma Developing from the Theca Externa of the Graafian Follicle," Am. Jour. Obst., 1902, vol. xlv, p. 182.

in one part and high cylindric in another. The cell protoplasm takes the eosin stain. The nuclei are small, oval or round, and are situated near the base of the cell.

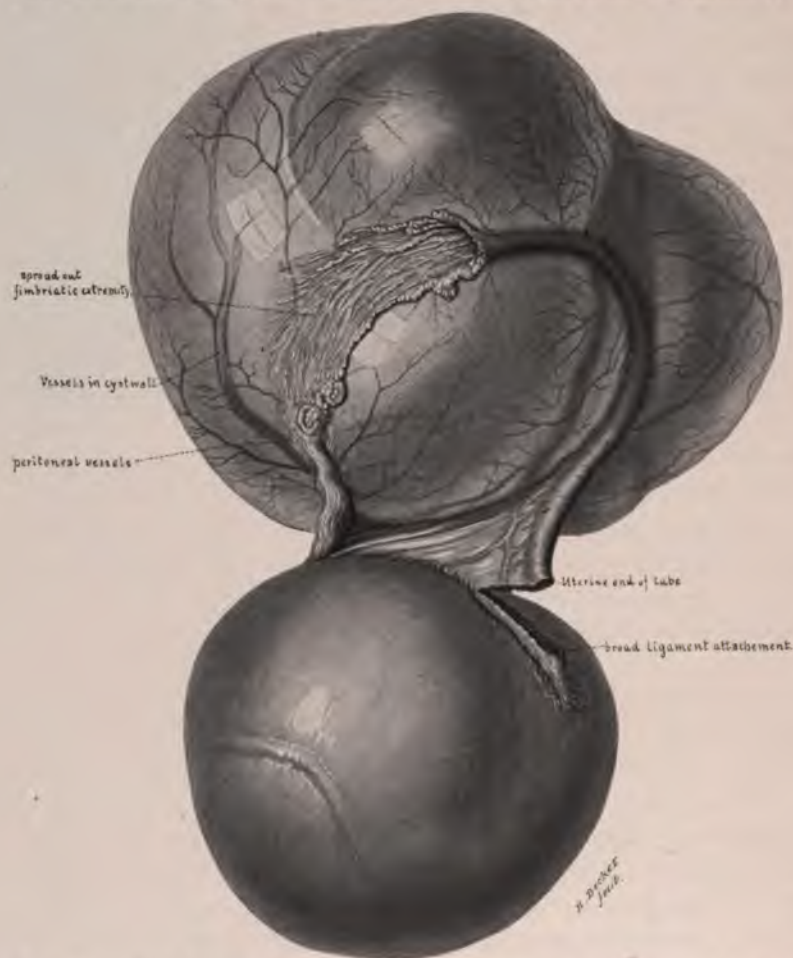


FIG. 142.—PAROVARIAN CYST ASSOCIATED WITH CYSTADENOMA OF THE OVARY. ($\frac{1}{4}$ natural size.) (After J. E. Stokes.)

DISEASES OF THE PELVIC CONNECTIVE TISSUE AND UTERINE LIGAMENTS.

Varicose dilatation of the veins of the pampiniform plexus is comparatively frequent and may produce a tumor mass of considerable size. The affection is usually associated with pregnancy or the presence of large uterine or ovarian tumors, but may also occur independently of any other pelvic disease. Thrombosis of the varicosity sometimes occurs and calcification of the thrombi may follow, producing phleboliths.

Hematoma of the parametrium is usually the result of childbirth and rupture of the uterus. It may, however, be produced by the rupture of varicose veins. Gebhard saw a fatal case in which there was no sign of uterine tear. Hematoma

of the vulva may also extend to the parametrium. Kanavel¹ describes cases of uncomplicated varicose ovarian veins, and Martin² described a case of idiopathic hemorrhage into the broad ligament and a case of hemorrhage associated with retroflexion of the uterus.

Inflammation of the pelvic connective tissue (parametritis, pelvic cellulitis, true pelvic abscess), in the absence of disease of the intraperitoneal pelvic organs, has long been recognized by foreign writers as a comparatively frequent result of puerperal infection, and may also, though rarely, be caused by infected vulvar and vaginal injuries in the non-puerperal stage. In America, Mundé and Noble³ have insisted especially upon the importance of recognizing this affection. The inflammation may be due to septic, gonorrheal, or tubercular infection. The infectious material may be conveyed by the lymphatics from an infected focus in the vagina or cervix, or may travel by way of the veins as a thrombophlebitis which usually originates from an infected placental site.

Acute pelvic cellulitis is characterized in the early stage by a transitory congestion and edematous infiltration of the tissue. This is followed by swelling and dense induration of the parametrium and broad ligament. In long-standing severe cases the phlegmonous infiltration spreads beneath the pelvic peritoneum, extends posteriorly into Douglas's cul-de-sac, anteriorly into the uterovesical and prevesical tissue, and laterally to the pelvic brim, forming a tumor mass which rises above Poupert's ligament and the iliac crest. There is often a slight, localized peritonitis due to the direct extension of the disease. Histologically, the early dilatation of the blood-vessels and serous transudation are soon accompanied by a leukocytic infiltration, hyperplastic connective-tissue proliferation, and the formation of new blood-vessels. The infection may terminate in resolution or in suppuration. Very extensive pelvic exudate and intraperitoneal adhesions can be wholly absorbed (Noble). Usually, however, a few dense fibrous bands remain and may cause marked distortion of the position of the pelvic organs.

Suppuration of the inflammatory mass begins in several foci, which may finally coalesce to form a single large abscess cavity. Very often there is only a small cavity lined with necrotic material in the center of a large dense tumor mass. The abscess may rupture into the vagina, rectum, or bladder, or it may persist for months, or even for a year or two, slowly increasing in size on account of the hyperplastic connective-tissue growth. Miller⁴ found living streptococci in an abscess of the left broad ligament which he opened twelve years after the infection. Gonorrheal and tuberculous parametritis are rare and are usually secondary to tubal inflammation.

The differential diagnosis between parametritis and intraperitoneal inflammatory affections is usually readily made without recourse to abdominal section

¹ Kanavel: "Pelvic Inflammation," Am. Jour. Obst., vol. li, p. 480.

² Martin: Am. Jour. Obst., vol. li, p. 529.

³ Noble: "Acute Puerperal Cellulitis, etc.," Am. Jour. Obst., 1894, vol. xxvii, p. 447.

⁴ Miller, G. B.: "The Occurrence of the Streptococcus Pyogenes in Gynecological Diseases," Am. Jour. Obst., 1899, vol. xxxix, p. 780.

if the possibility of this condition is kept in mind during the examination; the situation of the mass, and the infiltration of the paravaginal and paracervical tissue, are distinctive.

New growths of the parametrium include simple cysts, dermoid cysts, fibroma, myoma, lipoma, hypernephroma, and sarcoma.

Accessory suprarenal bodies are comparatively frequent in the broad ligament and are usually found as multiple small nodules situated on the free border of the peritoneal fold along the course of the ovarian vessels. Histologically, they consist of a central blood-vessel surrounded by a vascular network, the meshes of which contain the characteristic adrenal cells. These bodies, according to Rossa,¹ may be the origin of some of the small subserous cysts on the posterior surface of the broad ligament, and v. Rosthorn² believes that both the cystic and solid tumors developing in the outer portion of the broad ligament may be derived from the accessory suprarenal bodies.

Cysts of the broad ligament are frequent. The majority are small, but some are of very large size. The large parovarian cysts have been considered separately. The origin of many of the small cysts is obscure. Some are lined with endothelium and are probably simple lymphangiectases. Others are lined with epithelium of variable appearance. In some the cells are cuboid, others cylindric, and some ciliated. The walls consist of fibrous tissue, with sometimes a variable amount of smooth muscle. Kossmann ascribes these cysts to accessory tubes, or Nebentuben, hence to the Müllerian ducts. Handly believes that the cysts of the broad ligament situated above the Fallopian tube arise from accessory tubes. Gebhard agrees with Fabricius that the small cysts, lying too far from the parovarium to be related to it, arise from inclusion of germinal epithelium.

Dermoid cysts develop in the subperitoneal connective tissue and never between the folds of the broad ligament (Gebhard). They are simple cysts, containing sebaceous material and rarely hairs and bone. They are quite distinct from the ovarian embryomata, and originate from inclusion of ectoderm (Sänger³). J. Riddle Goffe⁴ describes a teratoma of the broad ligament observed in a young girl.

Myoma and fibroma are the most common solid tumors of the broad ligament. The myomata in many cases are probably uterine tumors which have developed in the broad ligament and have become separated from the uterus.

Lipoma of the broad ligament is rare. Campbell⁵ described a case in which the tumor reached the umbilicus. According to this writer the lipomata developing in the broad ligament are benign tumors, in contrast to the retroperitoneal tumors, which are usually malignant.

Sarcoma may develop from the pelvic connective tissue as a secondary change

¹ Rossa: "Accessory Suprarenal Bodies," Arch. f. Geb. u. Gyn., Bd. lvi, S. 296.

² v. Rosthorn: "Krankheiten des Beckenbindegewebes," Veit's Handbuch, Bd. iii-2, 1 abt.

³ Sänger: "Dermoid Cysts of the Broad Ligament," Arch. f. Gyn., Bd. xxxvii, S. 100.

⁴ Goffe, J. Riddle: "Teratoma of the Broad Ligaments," Am. Jour. Obst., May, 1904.

⁵ Campbell: "Lipoma of the Broad Ligament," Brit. Med. Jour., 1903, vol. ii, p. 139.

in a myoma, or from accessory suprarenal bodies. Gebhard described a circumscribed tumor, the size of a small infant's head, which had developed between the folds of the broad ligament. It presented a brownish-red appearance and was infiltrated with numerous hemorrhages. Macroscopically, the tumor consisted of small round cells. The myosarcomata are probably often primarily uterine tumors.

Echinococcus disease of the female pelvic organs attacks most frequently the pelvic connective tissue, and especially the retrocervical, or prerectal, tissue (Freund). The cyst, which may be as large as a child's head, is surrounded by a zone of chronic inflammatory tissue. The cyst may rupture into the peritoneal cavity, or may empty itself into the rectum, vagina, uterus, or bladder. Retrogressive and degenerative processes—calcification, suppuration, or putrefaction of the contents—may occur, or even absorption of the dead vesicles. The disease is usually mistaken for an ovarian cyst or a myoma of the uterus, and must also be differentiated from parametritis and pelvic hematocele.

ROUND LIGAMENT.

The round ligament is seldom the seat of primary disease, although often secondarily invaded by extension from the uterus. The primary diseases most frequently noticed are hemorrhage and benign tumors.

Hemorrhage into the substance of the ligament may result in the formation of a hematoma of considerable size in the inguinal region or surrounding the intra-pelvic portion of the ligament. The etiology is obscure.

Adenomyomata, identical morphologically with the adenomyomata of the uterus, have been described by several writers, notably Cullen,¹ Pfannenstiel,² Bluhm,³ and Blumer.⁴ The tumor may develop in either the intrapelvic or vulvar portion of the ligament, or within the inguinal canal. In Cullen's case adenomyomata were present in both round ligaments. In Blumer's case the tumor was cystic, and in this case as well as in Cullen's the presence of blood pigment in the glands and in the stroma was noted. The origin of these tumors is obscure; their situation suggests a Wolffian body origin.

Pure fibromata and myomata are rare in the distal portions of the ligament, but the latter are frequently found a short distance from the uterus and are probably often merely displaced there. Amann⁵ has operated upon three cases of fibroma of the round ligament; in one case the tumor was bilateral.

¹ Cullen: "Adenomyoma of the Round Ligament," Johns Hopkins Hospital Bull., 1896.

² Pfannenstiel: "Ueber die Adenomyoma des Genitalstrang," Verhand. der Deutsch. Gesellschaft. f. Gyn., 1897.

³ Bluhm, Agnes: "Zur Pathologie des Lig. rotundum Uteri," Arch. f. Gyn., 1898, Bd. lv, S. 647.

⁴ Blumer: "A Case of Adenomyoma of the Round Ligament," Am. Jour. Obst., 1898, vol. xxxvii, p. 373.

⁵ Amann: "Fibroma of the Round Ligament," Frommel's Jahrbuch, 1904.

CHAPTER IV.

MEDICAL GYNECOLOGY.

BY CHARLES P. NOBLE, M.D., AND BROOKE M. ANSPACH, M.D.

INTRODUCTION.

To value operative treatment only in gynecology, is an error, which perhaps has been frequently made in recent years. On general principles, operative treatment should never be selected when non-operative measures will give results equally as good. The selection of operative or of non-operative measures in a given case depends upon the nature of the condition and upon the social position of the patient. In many gynecologic diseases nothing but operation can be considered. In others, the patient may be allowed to choose between the non-operative and the operative plan of treatment. The choice will sometimes depend upon the amount of time at her disposal. In still other cases the medical and the operative plans of treatment must be combined to secure the best result. The present chapter, on Medical Gynecology, has been written to supply the information needed by the family physician for his practical work. For this reason the scope of the chapter has been broadened in a few particulars, encroaching somewhat upon the field of obstetrics, in dealing with puerperal and pelvic inflammation.

As the use of drugs in gynecologic affections does not present any peculiarities, it will be considered in conjunction with those local measures which are commonly employed in gynecologic practice. Only such means of local treatment will be considered as are of real value.

PRINCIPLES AND ARMAMENTARIUM OF LOCAL TREATMENT.

To carry out the measures which are serviceable in gynecology, the physician will need to acquaint himself with certain principles which govern them, and with the instruments and the apparatus which are required.

Asepsis in Gynecologic Examination and Treatment.—At the present time it is hardly necessary to dwell upon the importance of asepsis in all forms of surgery, be it major or minor. Every physician of intelligence and of conscience will take care lest he unwittingly deposit infection in an operative area. Although there are few gynecologic maneuvers in office practice which are capable of being the means of implanting an infection which will immediately endanger life, a careless or a slovenly regard for aseptic usage may transmit a troublesome infection from one patient to another, or may seriously interfere with the efficacy of the treatment. The latter statement is especially true in cases where the treatment is directed

against a chronic infection. If a new infection is possible at each treatment, the result is not likely to be good.

Although in the better grade of practice very few of the venereal class of disorders, except gonorrhea, are encountered, it is a very great misfortune and an inexcusable error on the part of the physician if he becomes the agent in transmitting any of these diseases from one patient to another. And although syphilis and chancroid are rare in the upper classes, it is possible for them to occur in any walk of life. Except, therefore, in the maneuvers of local treatment which are especially dangerous—the aseptic details of which will be fully described—the aseptic measures which the gynecologist employs in his office work will serve especially to avoid the conveyance of infection from one patient to another.

Sterilizing Apparatus.—The instruments employed in the examination or treatment of gynecologic patients should be prepared for use by boiling them for five minutes in a 1 per cent. carbonate of soda solution. For this purpose a sterilizer, such as that shown in Fig. 3, is suitable. The instruments may be cooled by immersion in cold sterile water. After using they should be thoroughly scrubbed with hot water and liquid soap and then boiled as before. If the instruments are disinfected in the above manner, and are laid away wrapped in a clean towel, or otherwise protected from dust, they may be used for the ordinary examinations without any further preparatory sterilization. For the disinfection of dressings, tampons, lubricants, etc., a portable sterilizer, as shown in Figs. 1 and 2, will answer every purpose. The sterilized articles should be stored in covered jars or in some other way protected from contamination.

Lubricant.—Sterilized petroleum jelly of the finest grade makes a very satisfactory lubricant and one that protects the fingers better than any other. The difficulty sometimes experienced in removing an oily substance from the hands, and the frequency with which portions of it will be left about the roots of the fingernails, have been urged as objections to petroleum as a lubricant. A very satisfactory lubricant and one that is easily removed from the hands is composed of

Gum tragacanth	gr. cccxlviii
Carbolic acid	ꝰ xxxij
Glycerin	f ℥iij
Water sufficient to make	f ℥xxxij

Whatever lubricant is selected should be sterilized and kept in a closed vessel. A small portion of it may be poured upon the fingers as required. The fingers should never be stuck into the lubricant, unless a little of it is placed in a glass or porcelain cup which is changed for each patient. This is more expensive than the method first suggested.

Preparation of the Patient for Examination.—An empty bladder, an empty rectum, and a well relaxed abdominal wall are essentials for a satisfactory pelvic examination. The external genitals should not be cleansed until the examiner has inspected them. After the visual examination, any discharge should be carefully wiped away with pledgets of cotton before the finger is introduced into the

vagina. In the presence of acute vulvitis, digital examination should be avoided.

When digital examination of the rectum follows the vaginal examination, care should be taken that any discharge which has escaped from the vagina is wiped away from the region of the anus and the perineal body.

Preparation of the Examiner's Hands.—The hands are washed with hot water and soap, dried upon a fresh towel, and anointed with a sterile lubricant. Whenever, for any reason, there is a probability of venereal disease, and in patients who are uncleanly, the examiner should protect the vaginal hand with a rubber glove; the abdominal hand usually needs no protection.

When rectal palpation is desirable after vaginal examination, the glove should



FIG. 143.—OFFICE EXAMINING TABLE.

be changed for a fresh one, or a rubber finger-cot may be used. The latter does not protect the base of the examining finger, and if there are any evidences of infection the glove should be chosen. Rectal examination is always to be preferred to vaginal examination in young and unmarried women, and the finger should always be protected in making it. Gloves and finger-cots, after soiling, should be thoroughly washed, then boiled, dried, and powdered. They should be kept wrapped in a clean towel, and may be used when needed without any further preparation. A small amount of talcum powder will assist the examiner to draw the glove upon his hand. After the examination of septic cases, when gloves are not used, the hands should be thoroughly disinfected with a solution of bichlorid of mercury (1 : 1000), after washing them with soap and hot water.

Position for Local Treatment and Table.—The dorsal position is used in routine practice; occasionally the knee-chest or the Sims position is employed. An examining table is more satisfactory than a chair. The table should be 3 feet high, $3\frac{1}{2}$ feet long (Fig. 143), and slightly lower at the head than at the foot. For a routine examination or treatment the feet are most conveniently held upon a transverse bar of wood, which is fastened to longitudinal pieces on each side,



FIG. 144.—KNEE-CHEST POSITION (Fowler).



FIG. 145.—SIMS' POSITION (Fowler).

pulling out of the foot of the table like a drawer. When a more prolonged treatment is required, or if complete relaxation of the abdominal muscles is desirable, the feet are elevated in stirrups and the buttocks are brought well over the edge of the table. The supporting rods must be at the very end of the table and the feet must be secured in the stirrups, to the inner side of the supports. In this way the feet are brought nearer together while the knees fall further apart, thus relaxing the abdominal muscles. In the treatment of retroversion by means of tampons

and pessary, the knee-chest position (Fig. 144) offers many advantages. Although this position is at first decidedly disagreeable to patients, it becomes less so when they have assumed it several times. The knee-chest position is not always correctly taken. If upon the introduction of the Sims speculum and the retraction of the posterior vaginal wall the vagina does not become distended, either the assumption of the position is faulty or there are pelvic adhesions. Care should be taken to see that the spinal column is relaxed and bent forward. The chest must be brought in contact with the table and the thighs must be vertical. Sims' position (Fig. 145) may be substituted with advantage for the knee-chest position in a limited number of cases when, for any reason, the latter is unsuitable. The patient lies upon the left side with the left arm behind her; the trunk is rotated so that the front of the chest lies in contact with the table; the thighs are flexed at right angles to the abdomen and the legs at right angles to the thighs. The right thigh is then flexed more than the left so that the right knee lies above the left. A cushion placed beneath the buttocks increases the inclination of the pelvis and may be of consider-

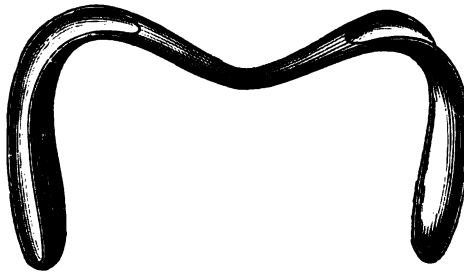


FIG. 146 —Sims' SPECULUM.

able assistance. Before attempting either the Sims or the knee-chest position, the patient must remove her corsets and loosen all bands about the waist.

Specula.—Sims' specula of two sizes, a bivalve and a trivalve speculum, and a large size Kelly cystoscope, are needed. The Sims speculum (Fig. 146) is used (1) to inspect the cervix and the vaginal walls; (2) to apply tampons with the patient in the Sims or in the knee-chest posture; and (3) to adjust a pessary. The bivalve or the trivalve speculum is used for inspection of the cervix and the vaginal walls and in the application of tampons and direct local treatment. The large size Kelly cystoscope is of advantage in virginal or nulliparous women for inspection of the vaginal vault and the cervix. There are various patterns of bivalve and trivalve specula on the market. The authors have found Howard's bivalve (Fig. 147) and Nott's virginal trivalve (Fig. 148) specula especially serviceable. Graves' bivalve speculum may also be used. Goodell's bivalve speculum is rather complicated.

The bivalve or the trivalve speculum is introduced with its blades closed, well lubricated, and in the oblique axis of the vagina. It is well to make a digital examination just before introducing the speculum in order to determine definitely

the position of the cervix and the area to be inspected. The speculum can then be directed toward that part. When introducing the Sims speculum with the patient in the knee-chest or in the Sims position, the blade of the instrument should be introduced with its transverse diameter in the oblique diameter of the vagina. After introducing the blade to its full length, the instrument should be rotated until the convex surface of the blade is applied to the posterior vaginal wall, when traction backward should be made.

Forceps.—Applicating or dressing forceps with locking handles (Bozeman's



FIG. 147.—HOWARD'S BIVALVE SPECULUM.



FIG. 148 —NOTT'S TRIVALVE SPECULUM.

uterine dressing forceps, Fig. 149, is the best pattern) are useful in applying tampons and in cleansing the cervix, vaginal vault, etc., of discharges.

Applicators.—For the application of various preparations to the vaginal vault and the cervix an ordinary nasal applicator may be used. Better than anything else are small slivers of wood (toothpicks) wrapped at the end with cotton. These may be held in the jaws of the applicating forceps. They should be burned after using. Intrauterine applications should be made only in a limited

class of cases, such as will be described in a subsequent section (the Treatment of Endometritis, page 266).

Double Tenacula.—A double tenaculum (Fig. 29) is often required in making a pelvic examination to draw the uterus within easy reach of the palpating finger. It is useful also to steady the uterus in making applications to the cervical canal, etc. A single tenaculum may be used for this purpose, but it is less satisfactory (Fig. 152).

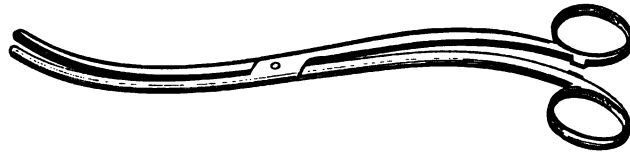


FIG. 149.—BOZEMAN'S UTERINE DRESSING FORCEPS.



FIG. 150.—NOBLE'S WHALEBONE APPLICATOR.



FIG. 151.—APPLICATORS AND APPLICATOR HANDLE.



FIG. 152.—SINGLE TENACULUM.

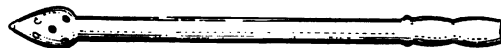


FIG. 153.—GLASS DOUCHE NOZZLE.

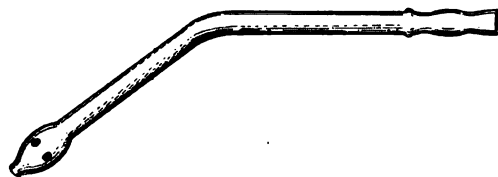


FIG. 154.—GLASS DOUCHE NOZZLE.

Douche Nozzle.—Douche nozzles should be of glass (Figs. 153 and 154). The end should be bulbous and closed, and the perforations should be at the sides. There should be no terminal opening directly in the axis of the nozzle. In this way the danger of forcing a solution directly into the cervical canal is avoided.

An intrauterine douche nozzle for the uterus itself is scarcely ever required in office practice. For washing out any other cavity it is valuable. Fritsch's modification of Bozeman's model (Fig. 43) is the best.

Syringes.—A fountain syringe, and a hypodermic syringe with a blunt-pointed needle, are sufficient. A piston syringe should not be used to give douches. Intra-uterine injections should not be employed in office practice. The hypodermic

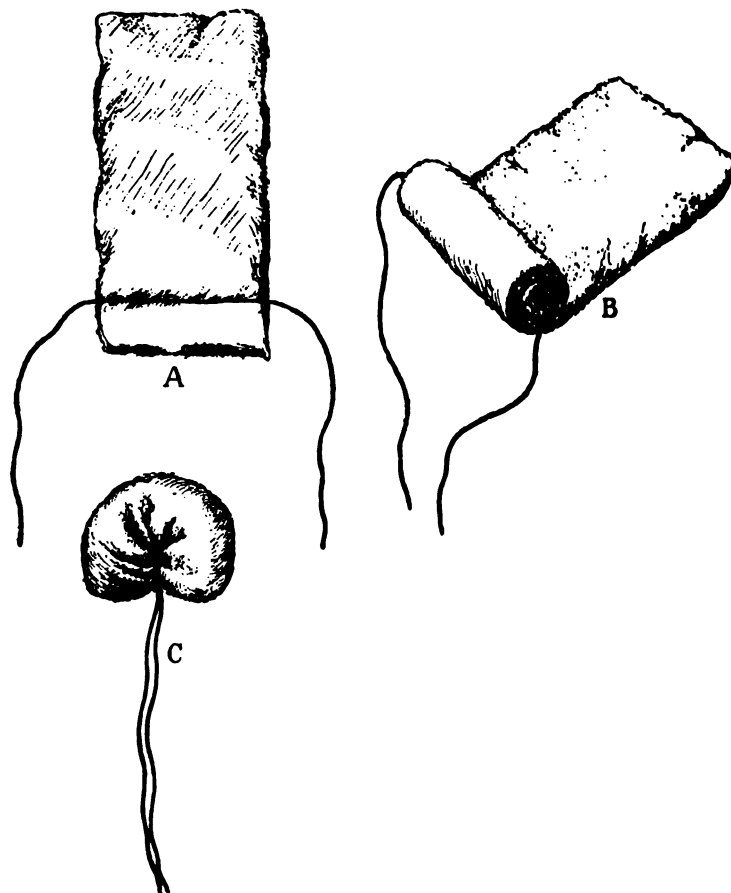


FIG. 155.—COTTON VAGINAL TAMPONS.

syringe with a blunt needle is useful in the treatment of infections localized in Skene's tubules, Bartholin's glands, or the urethral crypts. Emmet¹ believes that a vaginal douche given with a bulb syringe is more efficacious, in the treatment of pelvic congestion and of pelvic exudate, than one with the fountain syringe. He says that a steady stream is never as serviceable as an interrupted current from a Davidson syringe. He claims that, in addition to the heat of the water, the

¹ Emmet, Thomas Addis: "The Principles and Practice of Gynecology," Phila., 1894.

intermittent jet from the syringe acts as a stimulus which excites the blood-vessels to contraction.

Douche-pan.—The best form of douche-pan is rectangular in shape and of equal depth throughout. It should hold at least one gallon. There should be ample provision for the support of the buttocks.

Vaginal Tampons.—Tampons are made of absorbent cotton (Fig. 155), or of lamb's wool, or of both (Fig. 156). For the simple application of medicaments a tampon of absorbent cotton will suffice. If it is desirable that the tampon should exert pressure or support, it should be reinforced with lamb's wool. The plain absorbent cotton tampon is made by rolling a flat piece of absorbent cotton, of an oblong shape, about a string and then bringing the ends of the cotton roll together by tying the string. In this way the string is buried in the cotton and all of the latter is securely attached, and there is no danger that when the patient attempts to remove the tampon some of it will be left behind. The lamb's wool tampon is



FIG. 156.—LAMB'S WOOL AND COTTON VAGINAL TAMPON.

made by taking a strip of absorbent cotton and one of lamb's wool, tying them together in the middle, and folding them so that the lamb's wool lies within the cotton. Tampons, especially those used in the treatment of retrodisplacement, should be varied in size to suit the requirements of the individual patient. They can be made up as the occasion demands, or several sizes can be kept on hand.

For the purpose of applying a medicament the tampon is soaked in the solution (simple cotton tampon) or filled with it (lamb's wool tampon), and applied directly to the desired area through a speculum. The tampon is held in place by means of a dressing forceps while the speculum is withdrawn. The patient should always be informed of the presence and the number of the tampons. The string attached to the tampon facilitates its removal; it should be left hanging from the vaginal outlet. The tampon should never be left in place for more than twenty-four hours. After its removal a cleansing douche should be given.

Electric Outfit.—*Galvanic Current.*—Neither of the authors has had much experience with electricity in the treatment of gynecologic affections.

The essentials for gynecologic treatment are a very strong current (20 to 100 milliamperes), a very smooth one (with the almost complete avoidance of shock), and the direct application of the active pole to the part which it is desired to affect. The female pelvic viscera are well adapted to electric treatment because the current can be confined to certain regions; the diseased tissues can be reached directly by the electrode; the pelvic organs have a low electric sensibility, and high currents may be used without much pain. The effects of a galvanic current are spoken of as polar, interpolar, and general. The positive pole is sedative in its action and produces constriction of the blood-vessels in its vicinity. The negative pole is irritant and has a vigorous vasodilator effect. The general effect of the galvanic current is said to be tonic, and the interpolar effect is spoken of as electrolysis and cataphoresis.

Apparatus.—For the application of galvanism to the uterus a portable or a wall-cabinet battery is required which is capable of generating a current of 100 milliamperes. The battery should be provided with a milliamperemeter in order to measure the current accurately; a rheostat, by which the strength of the current can be governed; and a commutator, to permit a change of poles without removal of the electrodes. The intrauterine electrode is made of material that can be thoroughly sterilized by boiling or by immersion in a 1:500 solution of formalde-

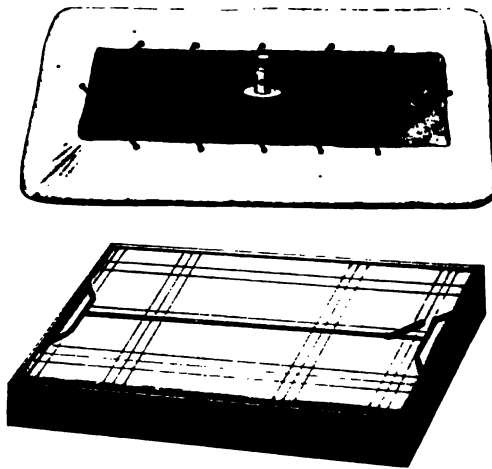


FIG. 157.—ABDOMINAL ELECTRODES.



FIG. 158.—INTRAUTERINE ELECTRODES.

hyd. The external electrode consists of a sheet of metal, 6 by 4 inches in size, covered with quilted gauze (Fig. 157). The intrauterine electrode is protected along its butt and shank by a rubber tubing or by gutta-percha (Fig. 158).

The patient is prepared for the application of an electric current by a thorough evacuation of the bowels and the bladder, and by the removal of the corset and the loosening of any undergarments which would hinder direct application of the external electrode to the abdominal skin. Before making the application the vagina

and the cervix should be exposed by means of the bivalve speculum, and the entire vaginal vault and the cervix should be thoroughly scrubbed with green soap and hot water. This is rinsed out with sterile water and the vagina is packed with pledgets of cotton, soaked in bichlorid solution (1:2000). The pledgets are left in place for five minutes, while the operator prepares the battery for use, attaching the electrodes and applying the external one to the surface of the hypogastrium. The wet bichlorid cotton is now removed from the vagina and the cervix is wiped off with sterile water. The active electrode, or the one which is to be introduced into the genital canal, is rinsed with sterile water. If the applica-

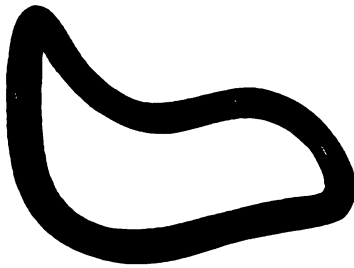


FIG. 159.—SMITH-HODGE PESSARY.

tion is to be made to the interior of the uterus, the electrode must be introduced, under full sight, directly into the cervical canal. It may be necessary to catch the cervix with a tenaculum, to steady it and straighten out the canal, during the first few applications. Usually hereafter the tenaculum will not be needed. A current of from 30 to 50 milliamperes should be used for five minutes. The application should be employed several times a week for several months. The abdominal surface

beneath the external electrode may exhibit considerable irritation of the skin after an application. The skin may be very much reddened and show a number of minute vesicles. These usually disappear in a few hours and leave no permanent marks. The intrauterine electrode has a more or less similar local effect. Actual destruction of the tissues is not met with except in the use of a current stronger than that mentioned, and it is not advisable to carry the process to such an extent.

Faradic Current.—In using the faradic current one pole is applied inside the

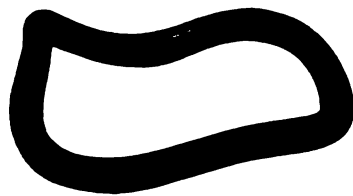


FIG. 160.—HODGE PESSARY.

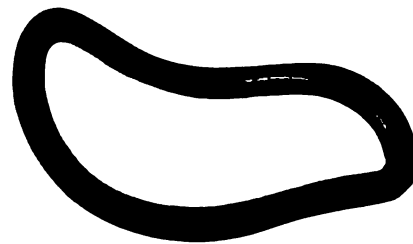


FIG. 161.—EMMET PESSARY.

vagina or the uterus: the other is placed upon the abdomen. A bipolar electrode is useful in which the negative and the positive poles are placed in the same electrode, with a band of non-conducting material between them. In this way the current is limited, more strictly, to the tissues it is desired to affect and there is less pain. The faradic current may be applied three times weekly, or even daily, each sitting lasting from ten to thirty minutes. The electrode is first introduced; the current is then

opened slowly, and gradually closed before the electrode is removed. This is necessary in order to prevent pain.

Apparatus.—For the application of the faradic current a faradic battery, with either dry cells or a wet cell, and with provision for securing either the primary or the secondary current, and either rapid or slow interruptions, and also with a commutator, should be selected. The primary current is useful in stimulating muscles to contract; the secondary, in lessening pain.

Pessaries.—Four varieties of pessaries are sufficient for practical purposes. There is an endless number on the market. The pessaries of the Smith-Hodge, Hodge, and Emmet types are the most serviceable (Figs. 159, 160, and 161). Ring pessaries made of hard rubber and of soft rubber sometimes prove useful (Figs. 162 and 163). The Smith-Hodge pessary is the one usually employed for retroversion. The ring pessary is employed in cases of prolapsus or retroposition, in which the perineal floor is relaxed so that the ordinary pessary is not retained. The ring pessary is held in place by the rami of the pubes, and answers the purpose of supporting the bladder and the uterus in some cases in which an operation is unadvisable. The Emmet pessary is like the Smith-Hodge pessary in

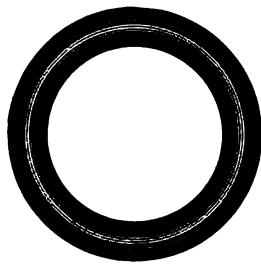


FIG. 162.—HARD-RUBBER PESSARY.

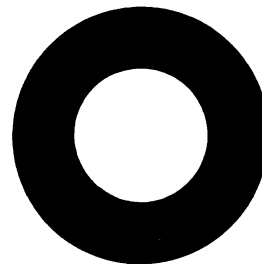


FIG. 163.—SOFT-RUBBER PESSARY.

form, but the posterior bar is not so high and the anterior bar is broader. It is to be preferred to the Smith-Hodge pessary whenever it will retain the uterus in good position, because on account of the lower posterior bar it is less likely to overstretch the uterosacral ligaments. The Hodge pessary differs essentially from the Smith-Hodge only in having a broader anterior bar. It should be selected when the perineal floor is slightly relaxed, because the anterior bar is broader than the anterior bar of the Smith-Hodge pessary and is less apt to slip through the relaxed introitus.

There are certain general principles to be observed in the use of the pessary.

A pessary must not be used for the purpose of exerting any pressure. In a case of retroposition the uterus must be replaced before the pessary is introduced. The instrument maintains the uterus in its normal position by the constant gentle traction it exerts on the uterosacral ligaments. It is reprehensible to use a pessary for retroposition of the uterus unless the organ can be replaced and can be retained in its normal position without exerting any force. A pessary should never be used in the presence of any intrapelvic lesion in which the upper bar of the pes-

sary would come in contact with, or exert pressure upon, the ovaries or the tubes. Thus, if the ovary is prolapsed, unless it moves out of harm's way when the uterus is replaced, the pessary should not be used. Enlargement of the ovary to any considerable extent, pelvic inflammatory disease, hydrosalpinx, pyosalpinx, and new-growths of any kind, are all positive grounds upon which to exclude the use of the pessary.

A pessary should only be introduced during pregnancy to prevent incarceration or the recurrence of retroversion or of prolapsus. Pessaries introduced before conception occurs may be retained during the early months of pregnancy or until the fundus rises well above the pelvic brim.

A pessary should always be fitted to the individual case. (See Treatment of Retroposition, page 273.) This is a very important point, and many failures are due to a careless selection of the pessary in a given case. When introduced the pessary should be large enough to be well supported by the structures of the pelvic outlet, and yet it must not be large enough to exert any considerable pressure upon the rectum, the urethra, or the vaginal walls. If the finger can without difficulty be passed between the pessary and the vaginal wall on every side, it may be taken as an indication that the pessary is not too large. The patient is directed to return to the physician within twenty-four hours after the first introduction of the pessary. If at that time the uterus is found in good position, if the patient has not experienced any pain, and if the finger can still be passed entirely around the pessary, then it may be taken for granted that the proper size has been selected. Should the contrary be true, the pessary must be removed at once and a refitting made. After the patient has been satisfactorily fitted she should be informed that if at any time there is pelvic pain or an unusual vaginal discharge, she should immediately return to the physician; or, in case that is impossible, she herself should remove the pessary.

The pessary should be taken out for cleansing at least once every six weeks. It may be left out for several days. If then the uterus is found to have resumed an abnormal position, the pessary must be reintroduced. After six months of such treatment if the uterus still assumes a faulty position when the device is removed, the prospect of a cure by means of the pessary will be remote, and a choice between an operation and the permanent use of the pessary must be made. The patient should be instructed to take a vaginal douche, for the purpose of cleanliness, at least three times weekly during the time the pessary is in position. A daily douche is advisable if there is any vaginal discharge. An excellent douche consists of borax and bicarbonate of soda, of each half an ounce, dissolved in two quarts of boiled water. The use of any powder in douches while a pessary is in position has been condemned on the ground that the pessary will become incrustated with a deposit of the salt used and irritate the vagina. If the pessary is removed and cleansed every four to six weeks this will not happen. The typical conditions under which the pessary may be employed include a normal pelvic floor, and the absence of disease of the ovaries, tubes, and pelvic peritoneum. When the pessary is employed under

other circumstances it is but a makeshift form of treatment and will have correspondingly bad or poor results.

Pelvic Massage.—Thur  Brandt¹ devised and elaborated a system of pelvic massage and various movements of the extremities and the trunk which were directed against many varieties of pelvic disorder. His system received considerable attention for a time, but it has gradually become almost obsolete in this country. The authors believe that in a very few carefully selected cases, as hereinafter described, pelvic massage may be of service. It cannot be applied properly by any one who is not a skilful gynecologist. An ordinary masseur or masseuse, unless she devote a considerable time to the study of pelvic examinations, would be absolutely unfitted to practise this form of massage. The authors believe, moreover, that deliberate *s ances* of pelvic massage may lead to sexual excitation. It is, therefore, not recommended for general employment.

Olshausen² has given a reliable and trustworthy estimate of this treatment. He says that the claims of Brandt and the other advocates of pelvic massage are exaggerated. He draws a line of distinction between bimanual efforts at replacement of the uterus, or bimanual traction, and pelvic massage. By massage he understands a series of movements directed against an organ or an area which produces its effect by restoring the muscular tone of the part, or by the removal of exudates following an increased flow of blood. Olshausen believes that massage will be efficacious in puerperal cases of retroversion, when the uterus is heavy and congested. Cellular pelvic exudates, he says, are amenable to massage after all of the inflammatory symptoms have subsided. In a general way, Olshausen concludes that, except for old cellular pelvic exudates and uncomplicated puerperal retroposition, massage is of no use. The authors fully agree with him.

MENSTRUATION.

Menstruation (*menstruus*, "monthly") is a complex process whose most obvious sign is a periodic discharge of blood from the uterus. Menstruation occurs during the reproductive period and its onset and its cessation mark the beginning (puberty, *pubes*, grown to maturity) and the end (menopause, *μηνας*, menses; *παυσις*, cessation) of this part of a woman's life. The age of puberty is influenced by climate, race, social position, and mode of life. According to Englemann,³ the idea that menstruation begins very early in the tropics (nine to ten years) and very late in the far north (eighteen to twenty years) is a fallacy. From an analysis which he has made of sixty thousand cases, he finds that puberty begins quite as early among the Esquimaux as among the inhabitants of tropical countries. The negro maiden of Somaliland develops at sixteen, just as late as the Laplander and the Samoyed; and Esquimaux women become mothers at the age of twelve, just as early as the

¹ Brandt, Thur : "Behandlung weiblicher Geschlechtskrankheiten," Berlin, 1891.

² Olshausen, R.: "Zur gyn kologischen Massage," *Centralbl. f. Gyn k.*, 1901, Nr. 3.

³ Englemann, G. J.: "Das Alter bei der ersten Menstruation am Pol und am Aquator," *Centralbl. f. Gyn k.*, 1902, Nr. 46, S. 1125.

Hindu women. While higher temperatures favor early menstruation and lower ones have the opposite effect, this variation is seen more often in the distant parts of the same zone than in the extreme zones, like the tropical and the arctic. Thus, in the south of Europe puberty appears earlier than in the north. In the United States puberty appears at an average of about fourteen years; to the south somewhat earlier; to the north somewhat later. The early appearance of puberty in the polar regions is explained by the oily diet of these people, whereas the sluggish habit of the equatorial inhabitant accounts for its non-appearance there at an early date. The menstrual flow occurs periodically, usually at an interval of twenty-eight days. It consists of blood mixed with the excretions and the desquamated surface epithelium of the endometrium. Being intimately mixed with mucus, menstrual blood shows no tendency to clot. From the studies of Westphalen,¹ Mandl,² and his own, Gebhard³ concludes that at the time of menstruation there is a passage of red and white blood-cells—whether by diapedesis or by rhexis it is not known—through the endometrial capillaries. This blood collects in the superficial part of the endometrium beneath the surface epithelium, through which it finally passes, detaching the epithelium here and there and carrying away small portions. The amount of menstrual blood lost at a single period is said to average 4 to 6 ounces. The flow lasts on the average for from three to five days; it may vary between one and eight days.

In regard to the regularity and the duration of menstruation and the amount of the menstrual flow, it may be said that every woman is more or less peculiar to herself. Thus, the menstrual interval may vary between three weeks and a full calendar month, and the length of the period and the amount of blood lost may be above or below the average. The customary peculiarities in the individual are spoken of as the *menstrual habit*, and this should always be considered in estimating the significance of menstrual symptoms. Menstruation does not always appear as a well-established function from the start. After its first appearance several months or even a year or more may elapse before it becomes periodic and regular. The process of menstruation is complex. Although in the most robust type of women the menstrual flow is its only evidence, in many women there are prodromal and coincident phenomena. Von Ott⁴ has found that metabolic activity is increased just before menstruation; it diminishes during the first few days of the flow, and becomes normal after the cessation of it. The recognizable manifestations of this comprise increased functional activity of the muscular, respiratory, circulatory, and nervous systems before the menstrual flow begins. After the

¹ Westphalen, Friedrich: "Zur Physiologie der Menstruation," *Archiv. f. Gynäk.*, Bd. lii, S. 35.

² Mandl, Ludwig: "Beiträg zur Frage des Verhaltens der Uterusmucosa während der Menstruation," *Ibid.*, Bd. lii, S. 557.

³ Gebhard, C.: "Ueber das Verhalten der Uterusschleimhaut bei der Menstruation," *Zeitschr. f. Geburtsh. u. Gynäk.*, Bd. xxxii, S. 296.

⁴ Von Ott: "Gesetz der Periodicität der physiologischen Funktion im weiblichen Organismus," Bericht über die Verhandlung des X Intern. Med. Congress, Berlin; *Centralbl. f. Gynäk.*, 1890, Beilage, S. 31.

flow there is a relative decrease. During the menstrual flow the patient may complain of lassitude, headache, pain in the lower abdomen or in the back and legs. The breasts may be engorged and painful. There is often some perversion of taste and of the other senses. Various neuroses may become manifest, and spots of pigmentation may appear upon the face. The widest variation of these symptoms may obtain, depending upon the temperament and the physique.

Precocious Menstruation.—Menstruation is spoken of as precocious when it occurs before the usual period of puberty. The irregular hemorrhages from the uterus which are sometimes seen during the first few weeks of life, and which may recur several times, cannot be regarded as precocious menstruation. In true precocious menstruation the hemorrhage occurs at regular intervals and the individuals show physical and mental indications of sexual maturity beyond their years. The occasion of this condition is apparently a hyperplasia of the ovaries. It has sometimes accompanied hydrocephalus, rickets, and sarcoma of the ovary. Ploss¹ has collected forty-four cases, the youngest patient being two months old.

Delayed Menstruation.—Menstruation is spoken of as delayed when its onset does not occur until after the usual age. This really constitutes one of the forms of amenorrhea.

Pathology of Menstruation.—The relation between menstruation and ovulation is a close one. Leopold and Mironoff² have made extensive observations upon this subject. They examined 42 cases at operation or at autopsy, and found that in 30 ovulation and menstruation were synchronous. In 10 instances ovulation had not occurred at the time of the menstrual period. Arnold³ also found that ovulation did not always coincide with menstruation; in but 39 out of 54 operative or post-mortem cases was there a fresh corpus luteum at the close of the menstrual period. As an instance of the fact that ovulation may take place without menstruation, Stengel⁴ reports a case of pregnancy and childbirth in a woman, aged twenty-one, who had never menstruated. The woman was in robust health and had been married three years when conception occurred. Ovulation evidently occurred in this case without menstruation. As a further example of this it may be noted that pregnancy frequently occurs during lactation when the periods have been entirely absent. Gebhard⁵ relates a case of Krönig's in which conception occurred four days after labor. It may, therefore, be said that as a rule menstruation and ovulation are synchronous, but that menstruation may occur alone without coincident ovulation, and that ovulation may take place without

¹ Ploss, H.: "Das Weib in der Natur und Völkerkunde," Bd. i, Aufl. viii, S. 414; Bearbeitet von Max Bartels, Leipzig, 1905, Th. Grieben.

² Leopold, Prof. u. Mironoff: "Beiträge zur Lehre von der Menstruation und Ovulation," Archiv. f. Gyn., Bd. xlv, S. 506.

³ Arnold: "Ueber das zeitlichen Verhältnis der Ovulation zur menstruellen Blutung," Inaug. Dissert., Würzburg, 1897.

⁴ Stengel, Alfred: "Ovulation and Menstruation," University Med. Magazine, Feb., 1891, vol. iii, No. 5, p. 233.

⁵ Gebhard, C.: "Die Menstruation," Veit's Handbuch der Gynäkologie, Bd. iii, Heft 1, S. 18.

menstruation. Menstruation is, however, dependent upon the activity of the ovary, and unless follicle-bearing tissue is present in the ovary of the individual, menstruation will not occur. The observations of Clark¹ upon the ovary show that menstruation begins at the time when the Graafian follicles in their development approach the surface of the ovary and rupture into the free peritoneal cavity. When there are but a few follicles left in the ovary, and the organ has become almost entirely a mass of scar tissue, menstruation ceases. It cannot be denied that both ovulation and menstruation are governed by a common influence. It is certain that menstruation ceases if the ovaries are removed, and the metabolic activity of the ovaries, whatever that may be, is essential to it.

The menstrual flow is the most obvious of the menstrual phenomena and has the greatest significance. Ordinarily, it may be said that the woman who menstruates is capable of conception, and vice versa. Both ovulation and the menstrual flow depend immediately upon an intense congestion of the ovaries and of the uterine mucosa. In the first the increased tension results in the bursting of the Graafian follicle; in the second it results in the menstrual diapedesis. The menstrual flow is modified by abnormalities both in the uterus and in the ovaries. If the uterus be imperfectly developed, the diapedesis will be correspondingly affected. If the ovarian tissue is not normal, the physiologic impulses of menstruation are faulty and the process is variously modified.

AMENORRHEA.

An absence of the menstrual flow during the reproductive period, excepting during pregnancy or lactation, is pathologic and is spoken of as amenorrhea. When the vaginal or the uterine outlet is occluded (congenital or acquired stenosis) there may be no external evidence of a menstrual flow even though it has occurred. In such cases the menstrual fluid is pent up within the genital canal. This condition may be spoken of as pseudo-amenorrhea. True amenorrhea depends upon, first, anatomic defects; second, constitutional diseases; third, psychic influences. Amenorrhea is permanent when it has an anatomic basis. Otherwise it is transitory.

Amenorrhea Due to Anatomic Defects.—Amenorrhea of this sort depends upon a faulty development of the ovaries, of the uterus, or of both. If functioning ovaries are present and the uterus is rudimentary, the subjective phenomena of menstruation occur at regular intervals, but there is no menstrual flow. The subjective phenomena in such instances are spoken of as the *molimina menstrua* (*molimen*, endeavor) and are usually quite distressing. When the uterus is well developed and the ovaries have undergone degeneration, menstruation may not occur at all. Amenorrhea which results from organic defects is usually congenital;

¹ Clark, John G.: "On the Origin, Development, and Degeneration of the Blood-vessels of the Human Ovary," Contributions to the Science of Medicine; Dedicated to Wm. H. Welch, Johns Hopkins Hospital Reports, vol. ix, 1900, p. 593.

it of course is not manifest until puberty. Even after the flow has been well established, permanent amenorrhea may be produced. Examples of this are found in degenerative processes which extensively involve both ovaries,—for example, bilateral sarcoma or carcinoma,—which destroy every particle of ovarian parenchyma. Amenorrhea has been observed to follow ovaritis complicating mumps. One of the authors has observed a case in which for seven months following parotitis there was no menstrual flow, and subsequently menstruation was never normal. Tait¹ attributes certain cases of atrophy of the ovary to ovaritis complicating the exanthemata (exanthematic oöphoritis), especially smallpox and scarlet fever. Other varieties of organic amenorrhea are found in cases of premature menopause (p. 242), hyperinvolution of the uterus, and in uterine atrophy. According to Thorn,² the uterus during lactation undergoes a certain amount of hyperinvolution due to the active contraction of the organ when the child is put to the breast. When the mother is anemic, or when the general health for one reason or another is impaired, the condition may pass into an actual atrophy of the uterus and be permanent. Engström³ does not believe that atrophy of the uterus always occurs during or on account of lactation. He observed it only in anemic and badly nourished individuals.

Amenorrhea Due to Constitutional Disease.—Any constitutional disease may produce amenorrhea by its effect upon the physical vigor of the individual. The chief disease of this class is chlorosis. Virchow⁴ believed there was a defect in the blood and in the circulatory apparatus, and that this affected the full development of the genitalia at the time of puberty. According to Stieda,⁵ chlorosis is a sign of degeneracy just as are infantile genitalia, infantile pelvis, and abnormalities of the cranial bones. He said that genuine chlorosis, which is not attributable to external noxious influences or disease, is a disturbance in development in the same sense as are the other indications of degeneracy which have been mentioned. Both the chlorosis and the condition of the genital organs and the pelvis under such circumstances are indications of a common trouble existing perhaps from the earliest stage of the individual's existence. While in many cases of chlorosis the genitalia are undeveloped, in many other cases the ovaries are enlarged. Indeed, occasionally chlorotic girls have menorrhagia instead of amenorrhea. Stephenson⁶ analyzed 232 cases of chlorosis and found that as a rule menstruation occurred at an earlier date in girls who had a tendency to, or who afterward did, develop

¹ Tait, Lawson: "Diseases of Women, and Abdominal Surgery," pp. 348–355; Phila., 1889.

² Thorn, Wilhelm: "Beitrag zur Lehre von der Atrophia uteri," *Zeitschr. f. Geburtsh. u. Gynäk.*, Bd. xvi, S. 57.

³ Engström, Otto: "Kenntniss der puerperalen Hyperinvolution der Gebärmutter," *Festschr. z. Feier d. 50 jähr. Jubiläums der Berlin Gesellsch.* Wien, 1891, S. 173.

⁴ Virchow, R.: "Ueber die Chlorose und die damit zusammenhängenden Anomalien im Gefässapparate," *Beiträge f. Geburtsh. u. Gynäk.*, Bd. i.

⁵ Stieda, Hermann: "Chlorose und Entwicklungsstörungen," *Zeitschr. f. Geburtsh. u. Gynäk.*, Bd. xxxii, S. 60 u. 97.

⁶ Stephenson, Wm.: "On the Relation between Chlorosis and Menstruation," *An Analysis of 232 Cases*; *Tr. Obst. Soc., London*, 1889, xxxi, p. 104.

chlorosis. Out of 183 there were 4 who had never menstruated, and these were aged fifteen, sixteen, and seventeen respectively. Out of 220, 12 per cent. menstruated only after the seventeenth year. In 47.5 per cent. of the cases menstruation was normal in every respect, both as to the time of onset and the amount of flow. In 20.7 per cent. it was slightly defective; in 26.7 per cent. it was markedly defective; in 2.7 per cent. it was imperfectly established; in 2.1 per cent. there was primary amenorrhea. In fully half of the cases, therefore, there was scantiness of the discharge and an increased interval between the periods; in no case was there what could be called menorrhagia. Recently it has been observed that chlorosis is less frequent in this country, and that this is true because of the increased participation of young girls in outdoor exercises, and the general recognition of the value of forced feeding (milk, eggs, etc.) in all stages of asthenia and malnutrition. The authors are inclined to believe that the relation between amenorrhea and chlorosis is the same as would obtain between amenorrhea and any constitutional disorder. After acute infectious diseases, and especially after typhoid fever, there is apt to be a cessation of the menstrual flow. Amenorrhea is also observed in tuberculosis, myxedema, Basedow's disease, diabetes, malignant growths, catarrh of the stomach, and leukemia. Recently attention has been called to the fact that amenorrhea may be one of the earliest symptoms of acromegaly and of Addison's disease.

Amenorrhea Due to Psychic Influences.—A woman who fears impregnation or one who greatly desires such a state may suffer temporarily from amenorrhea. This is exceptional, and should never be accepted as true in a given case unless the more probable explanation will not suffice. Terrible fright, or some awful catastrophe, may produce amenorrhea which may become permanent because of the ensuing atrophy of the genitalia.¹ A change of climate or altered social relations may temporarily suspend the menstrual flow.

Treatment of Amenorrhea.—The treatment of amenorrhea depends in a given case upon its particular cause.

Amenorrhea Due to Anatomic Defects.—Amenorrhea which is the result of an imperfect development of the uterus or of the ovaries is practically incurable. In some cases it will be difficult to say whether these organs are insufficiently developed for the process of menstruation or not. The ovaries are less frequently recognized as being absent or ill developed than the uterus. If in a given case the uterus is of good shape and presents a patulous cervical and endometrial canal, and the condition appears to be more an arrest than a perversion of development, hygienic measures and tonic or roborant treatment should first be tried, especially if the patient is seen during adolescence, in the hope of stimulating development, and if this fails, the galvanic current may be tried in an effort to increase the size of the organ. (See Scanty Menstruation, page 234.) The stem pessary has been recommended for the same purpose. (See Dysmenorrhea, page 237.)

If there is such a malformation of the uterus that little or no endometrium is present, and the cervical canal is short and ends blindly, such plans of treatment

¹ Case of Jaquet, Berl. Beitr. z. Geburtsh. u. Gynäk., Bd. ii.

are unsuitable. When the ovaries functionate actively in the presence of a deformed uterus which renders a menstrual flow impossible, the menstrual molimina may be so painful as to require oöphorectomy.

Amenorrhea Due to Constitutional Disease.—Amenorrhea depending upon constitutional causes must be treated indirectly. That is to say, when the constitutional lesion is cured, the menstrual flow will reappear as the result of the improvement in the general condition. The exhibition of Bland's pill modified with arsenic, the use of cod-liver oil, of forced feeding with milk and raw eggs, and of exercise in the open air and a general restoration to healthful activity of all the emunctories, will usually cure amenorrhea of this variety.

Amenorrhea Due to Psychic Influences.—When amenorrhea is due to fear or to a nervous shock, much can often be done by reassuring the patient. After the fear or the nervous shock has subsided the menstrual periods will return. If an actual psychosis is present it must receive special attention, disregarding the question of the menstrual flow for the time being and treating complications as they may arise. The friends of the patient, and she herself sometimes, may be warned with advantage that the relief of the symptoms will be slow.

Of amenorrhea in general it may be said that the exact cause in some cases cannot be determined. That is, one is often unable to say whether it is anatomic, constitutional, or psychic; it may be a combination of these. Practically, it may be said that if there is no anatomic lesion present which positively prevents menstruation, and if no result follows a restoration of the general health, as a final measure the faradic current should be applied to the uterine interior. Some authors recommend the stem pessary (page 234). It is unnecessary to say that intrauterine treatment is not permissible unless pregnancy can be excluded. Emmenagoges or drugs which are supposed to stimulate the menstrual flow are notoriously uncertain in their effect.

Cantharides is a very decided uterine stimulant, and according to Wood¹ in its combination with iron, aloes, and guaiac, as Dewees' emmenagog mixture, forms the most effective combination known. The formula follows:

R.	Tr. ferri chloridi,.....	f5 iij
	Tr. cantharidis,.....	f5 j
	Tr. aloes,.....	f3 ss
	Tr. guaiaci ammoniati,	f3 iss
	Syrupi q. s. ad,.....	f3 vj
M.	S.—Tablespoonful three times daily.	

Black oxid of manganese, gr. j-ij, administered before meals, has been recommended.

Savine, rue, and tansy are violent purgatives. Taken in sufficient dose to produce abortion, for which they are often used, they cause violent gastro-intestinal and nervous symptoms and may cause death. Pennyroyal and apiol are of little value.

¹ Wood, H. C.: "Therapeutics: Its Principles and Practice," 12th edition, p. 740. Phila., 1905.

MENORRHAGIA.

Definition and Etiology.—Menorrhagia, or an increase in the amount or the duration of the menstrual flow, may be produced by local diseases or by any general affection which produces a lack of tone in the circulation and predisposes to pelvic congestion. Incompetency of the cardiac valves and cirrhosis of the liver are the most frequent general causes. Menorrhagia may be due also to the hemorrhagic diathesis and to scurvy. Cumston¹ has recently called attention to the frequency of menorrhagia in kidney disease. It is a question whether the menorrhagia sometimes observed in chronic Bright's disease is not due more to the associated cardiac lesion than to the kidney insufficiency. Typhoid fever, cholera, variola, scarlatina, influenza, acute articular rheumatism, and syphilis, secondary or tertiary,² are also causes of menorrhagia. Among the local causes are endometritis, metritis, subinvolution, retrodisplacement, adenoma, polyp, fibroid tumor, sarcoma, and carcinoma of the uterus, pregnancy, and cystic degeneration of the ovaries.

Treatment of Menorrhagia.—The treatment of this symptom will always depend upon the underlying cause. One of the authors³ has grouped the plan of treatment of the various forms of menorrhagia according to the period of the woman's life in which it occurs.

Menorrhagia in young virgins is usually functional. It is due to some disturbance in the vasomotor nervous system, or to a relaxation of the tissues in general caused by the rapid growth which at times takes place about the time of puberty. Because of its pathology, menorrhagia in young virgins is usually curable by general treatment. It may be due to glandular hyperplasia of the endometrium and require curetage.

Menorrhagia occurring in young childbearing women is usually due to some mishap in connection with pregnancy or with parturition, such as the retention of the products of conception, laceration of the cervix or of the perineum, retrodisplacement of the uterus, subinvolution, inflammation of the uterine appendages, and pelvic congestion. Menorrhagia in this class of women is curable. It usually requires local treatment of an operative nature. When due to subinvolution and to malposition of the womb, operation will often be unnecessary.

Menorrhagia in women approaching the forties, and in those who are older, is usually due to gross disease of the uterus, such as a fibroid tumor, a polyp, an adenoma, or a malignant growth. Menorrhagia occurring in this class of women, except when due to advanced malignant disease, is curable, but almost invariably requires operative treatment applicable to the disease present in the particular case.

¹ Cumston, Chas. G.: "Menorrhagia in Interstitial Nephritis," Buffalo Med. Jour., vol. xlv, No. 11, June, 1905, p. 718.

² Jakesch, Wilhelm: "Ueber Menstruationsanomalien," Prag. medicin. Wochenschr., Jahrg. xvi, Nr. 18 u. 19, S. 207 u. 221.

³ Noble, Chas. P.: "Profuse Menstruation," Ann. of Gynec. and Pediat., 1894, vii, p. 334.

As menorrhagia is a symptom and not a disease, an exact diagnosis is requisite in every case. With the exception of virgins it is desirable that a physical examination of the pelvic organs be made at once. The importance of this examination becomes greater as the patient is advanced in years. Special considerations should influence the practitioner to postpone local examination in the unmarried unless it be reasonably certain from the symptoms that gross local disease is present.

There is no treatment of menorrhagia *per se*. By general measures, such as rest in bed and the use of digitalis, strychnin, and ergotin, pelvic congestion may be lessened, and in that way menorrhagia may be, at least in part, controlled; but it cannot be too strongly insisted upon that in every case of menorrhagia an exact diagnosis must be made, if possible, and the appropriate treatment addressed to the disease which is present. Simply as a palliative measure in menorrhagia of doubtful origin, or in those cases apparently due to a lack of tone of the uterine muscle a pill of

Ergotin.....	grs. j-ijj
Stypticin ¹	grs. ½-ijj
Hydrastinin hydrochlor. ¹	gr. ¼ or pulv. hydrastis gr. v.

may be given three or four times daily. Stagnin, a preparation made from the spleen of the horse, has recently been introduced by T. Landau² for use in cases of uterine hemorrhage. He has given it in 59 cases, comprising a great variety of lesions, with very gratifying results. We have had no experience with it. Adrenalin is efficacious when applied directly to the interior of the uterus. This is rarely suitable. If used at all it must be done under the fullest antiseptic precautions. The solution should be introduced by means of a cotton-wrapped applicator and never through a syringe. Boldt³ strongly recommends cotarnin hydrochlorid (stypticin), and believes that as usually employed it is given in too small a dose. In cases of menorrhagia the best plan, he says, is to begin with a 1 gr. dose given three times daily for about a week before the expected flow, and as soon as the flow begins 2½ grs. should be given every three hours and continued throughout the entire period. In instances of metrorrhagia 2½ to 5 grs. may be given at intervals of from two to three hours until the bleeding is lessened; then the dose may be decreased to from 1 gr. to 2½ grs. at intervals of from three to four hours. If a quick result is important, it is best to give 3 to 6 grs. in a 10 per cent. solution subcutaneously into the buttocks, using the customary antiseptic precautions. Because of its disagreeable taste it should be given in capsules. If no effect is produced at all by the drug after three large doses (2½ to 5 grs.) it is useless to continue it, as probably no good will result. The value of this drug must be determined by future experience.

¹ Both of these drugs are very expensive. It is well to bear this in mind.

² Landau, Theodor: "Ein neues durch Autolyse der Milz gewonnenes Blutstillungsmittel (stagnin)," Berlin. klin. Wochenschr., 1904, Nr. 22, S. 577.

³ Boldt, H. J.: "Cotarnine Hydrochloride in Uterine Bleeding," New York Med. Jour., Feb. 25, 1905.

METRORRHAGIA.

Definition and Etiology.—Metrorrhagia is the name given to uterine hemorrhage which is not synchronous with the menstrual flow. When menorrhagia and metrorrhagia are combined in the same case it is difficult sometimes to say when the first ends and the second begins. The causes of metrorrhagia are the same as those of menorrhagia. Metrorrhagia, however, is more frequently the result of dangerous lesions, such as carcinoma and sarcoma. Fibroid tumor, extrauterine pregnancy, syphilis, cardiac insufficiency, hepatic cirrhosis, cystic glandular endometritis, and endometrial polyp, are perhaps the most usual causes. A form of metrorrhagia occurring in childbearing women toward the end of menstrual life, which probably depends upon an alteration in the elastic tissue of the uterine wall, has recently been described by one of the authors¹ as *metrorrhagia myopathica*.

Treatment.—As in menorrhagia so in metrorrhagia, the underlying principle of treatment is to remove or correct the cause. Beyond this the same principles obtain as in the treatment of menorrhagia. As metrorrhagia is more serious and may threaten life, it is important that the treatment applicable to the particular case (usually operative) shall be promptly applied. The intrauterine application of the positive pole of the galvanic current is sometimes very effectual.

Atmocausis, or the introduction of steam into the uterine cavity, a measure introduced by Pincus,² is said to be very effectual in certain cases of menorrhagia. The object of atmocausis is to thoroughly cook the diseased endometrium so that its superficial part shall slough and any infectious organisms which it contains shall be destroyed. When the steam is applied beyond a certain limit, destructive atmocausis results; the entire mucosa and the inner fibers of the myometrium are devitalized, and after they have sloughed the apposed raw surfaces adhere and complete obliteration of the endometrial cavity results. The authors believe that curetage is preferable to the lesser degree of atmocausis. It is certainly less troublesome and it subjects the patient to less risk than atmocausis. Any procedure is objectionable surgically which leaves a sloughing surface. Hirst³ meets this objection very largely by first thoroughly cureting the uterus and then employing atmocausis for fifteen seconds. Atmocausis is spoken of as destructive when it causes obliteration of the uterine cavity. This result is deliberately sought by applying the superheated steam to the entire endometrium until not only the mucosa is thoroughly cooked but also the inner fibers of the myometrium. The slough which follows carries away every vestige of mucosa and the apposing raw surfaces unite. Practically, it is difficult to perform destructive atmocausis. The difficulty lies in affecting all parts of the endometrial cavity equally. When any part of the mucosa is not entirely destroyed the endometrium becomes regenerated subse-

¹ Anspach, Brooke M.: "Metrorrhagia Myopathica," Amer. Jour. of Obstet., Jan., 1906, vol. liii, p. 1.

² Pincus, Ludwig: "Atmokausis u. Zestokausis"; Wiesbaden, 1903.

³ Hirst, John C.: "The Causes and Treatment of Metrorrhagia," Amer. Jour. of Obstet., June, 1906, vol. liii, No. 6, p. 796.

quently at that point. If the cervical canal in such a case has been obliterated, accumulation of menstrual blood and of glandular excretions is sure to follow within the uterus. In general, hysterectomy is preferable to destructive atmocausis. The lesser degree of atmocausis may be tried in preference to hysterectomy in cases of persistent uterine bleeding, after the failure of curetage.

SUPPRESSION OF THE MENSTRUAL FLOW.

The menstrual flow may stop suddenly from several causes. The chief of these is taking cold. Wet feet and insufficient clothing for the lower extremities in wintry weather are contributory causes. Sea-bathing and the use of cold water for douching purposes also may produce a suppression of the menstrual flow. After suppression the menses may recur at the next regular period, or may remain absent for several months.

Treatment.—The nervous symptoms (*molimina menstrualia*) which occur at the time when the menstrual flow is due may be controlled by using the bromids, valerian and sumbul, either singly or in combination. The patient should be reassured that the menses will return at the proper time. The general condition should be improved by the use of the measures described under amenorrhea (page 229). The faradic current may be tried if menstruation does not reappear after the treatment already indicated has proved ineffectual. When menstruation is suppressed suddenly, as the result of exposure to cold or of sea-bathing, or of the use of a cold douche, there is evidence, usually, of violent pelvic congestion or even of inflammation. In such a case the patient should be confined to bed. Warm applications to the abdomen and hot vaginal douches of normal saline solution should be used. Sometimes the use of hot baths will reestablish the flow. They are advisable at each recurring period until menstruation is again normal.

VICARIOUS MENSTRUATION.

Occasionally in the presence of amenorrhea or of a scanty menstrual flow, bleeding may occur from the nose, lungs, throat, rectum, or almost any mucous surface. This is spoken of as vicarious menstruation and is supposed to replace the normal menstrual flow. In patients who have had this symptom the menstrual molimina were present, but the usual discharge of menstrual fluid from the uterine cavity did not occur or was very scanty. Theoretically, it is tenable that in the presence of functioning ovaries and a defective uterus, the menstrual impulse being strong and the uterus being unable to respond to that impulse, the discharge of blood from some other part might be established as a compensatory phenomenon. Neither of the authors has actually seen a case of vicarious menstrual flow. There is hardly any doubt that in many of the supposed cases an incorrect diagnosis has been made. The statement of the patient in supposed cases should not be accepted as positively true. It would be very easy for the patient to deceive

herself in this respect, and no case of vicarious menstruation can be considered authentic unless the patient has been under the strict observation of a physician.

Treatment.—The treatment of vicarious menstruation is very much the same as the treatment of amenorrhea. If the menstrual flow is once reëstablished the vicarious hemorrhage will usually cease within several months.

SCANTY MENSTRUATION.

The cause which produce amenorrhea may result in a scanty menstrual flow. Indeed, amenorrhea may be spoken of as absolute and relative. In relative amenorrhea or scanty menstruation the anatomic, constitutional, or psychic lesion, whatever it may be, is not so pronounced.

Treatment.—A woman normally may have a scanty menstrual flow. When the loss of a small amount of menstrual blood is accompanied by painful menses or when it is a variation from the usual menstrual habit in the individual patient, treatment is advisable. The treatment of scanty menstruation differs in no way from the treatment of amenorrhea (see Amenorrhea, treatment of, page 228), of which it is often the precursor. A scanty menstrual flow which depends upon an ill development of the uterus offers, according to Carstens, a favorable field for the use of the stem pessary. He believes that it excites the uterus to more or less periodic contraction, and results in an increased development of the myometrium. The hard-rubber stem pessary of Chapman or the Wylie drain are the varieties used (see Dysmenorrhea, treatment of, page 237). Galvanism also has been used with success in this condition by Bumm and Hirst (see Galvanism, and Treatment of Sterility, page 245). All ovarian or tubal disease must be excluded before either the stem pessary or the galvanic current is tried.

The results today from the use of the stem pessary will probably be better than in the preantiseptic period, when this form of treatment not infrequently caused salpingitis and peritonitis. Neither of the authors has employed the stem pessary, because of the possibility of causing salpingitis and peritonitis through infection.

Hygienic and tonic methods of treatment should be tried faithfully in scanty menstruation before resorting to local or to operative treatment. Especially is this true of young maidens, and of women under thirty-five years of age in whom scanty menstruation follows the rapid increase in adipose tissue.

DYSMENORRHEA.

Classification.—Dysmenorrhea may be said to exist when the subjective manifestations of the menstrual period are so exaggerated that the patient complains of marked pain or discomfort in the lower abdomen and pelvis. Severe headache and backache, occurring regularly at the menstrual periods, whether accompanied by pain in the lower abdomen or not, are also spoken of as forms of dysmenorrhea.

Dysmenorrhea depends upon a wide variety of affections of the uterus, tubes, and ovaries.

It may be caused by some trivial alteration of the uterus or of its adnexa, which is unrecognizable to the palpating hand or even to actual inspection of the pelvic organs during abdominal section. Kelly¹ notes the fact that many women are treated for dysmenorrhea, due to some slight pelvic lesion which is not recognized, as if dysmenorrhea were a disease and not a mere symptom. It would be extremely difficult to recognize certain lesions of a developmental nature which produce painful menstruation. By this is meant lesions affecting the musculature of the uterus and its nerve supply, or the ovarian stroma and capsule. Because of the apparent lack of any anatomic reason for many cases and the futility of all means of relief, there have been many classifications of dysmenorrhea. Dysmenorrhea which is associated with no palpable lesion has been spoken of as idiopathic, neuralgic, etc. The authors believe there is a form of dysmenorrhea which is purely nervous and which may be due to a faulty innervation of the uterus, be it an anatomic or a functional defect. This variety we have spoken of as neuralgic dysmenorrhea. Although the individual case of dysmenorrhea, as met with in practice, may depend upon several causes, and therefore cannot be said to represent any single type of lesion, this is the exception rather than the rule.

From an etiologic standpoint there are two chief varieties of dysmenorrhea:

- (1) Dysmenorrhea due to congenital defects.
- (2) Dysmenorrhea due to acquired lesions.

Dysmenorrhea Due to Congenital Defects.—*Etiology, Pathology, and Diagnosis.*—The abnormalities of the uterus which are held accountable for dysmenorrhea affect its size and shape. Thus, the uterus may be infantile in its development, either as a whole or as regards especially its cervical part. In such cases the corpus is often acutely ante flexed; the cervix is long, narrow, and tapering, or short and knob-like. These malformations affect the cervical canal more or less, which is either sharply kinked or the seat of a pronounced stenosis.

It has been supposed that in these developmental cervical defects the immediate cause of the dysmenorrhea is found in the obstruction which the acute ante flexion or the stenosed cervix presents to the outflow of the menstrual blood. In many cases complete relief of the symptom, after divulsion of the cervix, proves this to be true. It is difficult, however, to select the cases with any degree of certainty in which one can say that the symptom depends upon an obstruction to the outflow of menstrual blood. The gross malformation alone does not explain it, for there are cases in which these changes are well marked, and yet there is no dysmenorrhea. There is undoubtedly, as has been said, a form of dysmenorrhea which depends upon an imperfect development of the nervous mechanism of menstruation in which the usual subjective manifestations are grossly exaggerated. This may be spoken of as neuralgic dysmenorrhea. It is often true that in dysmenorrhea

¹ Kelly, Howard: "Dysmenorrhea: Its Causes and Treatment," Amer. Jour. of Obstet., New York, 1894, vol. xxix, p. 502.

which is associated with an anatomic defect the symptom may be the result both of an obstruction to the outflow of blood and of a deranged nervous mechanism.

Congenital or developmental dysmenorrhea, therefore, may be divided into an *obstructive* and a *neuralgic* form.

In the *obstructive* type the pain is paroxysmal and cramp-like, resembling miniature labor pains. It may exist for a day before the menstrual discharge occurs, subsiding as soon as the flow is well established. In other cases the paroxysms of pain return at intervals throughout the flow; there are a succession of painful contractions, each one exceeding the last in severity until, at the climax of the suffering, the uterus succeeds in expelling the menstrual fluid; the pain then subsides, and the patient notices an increased discharge.

In the *neuralgic* form of dysmenorrhea the pain often begins several days before the flow and it may last throughout the period. It may resemble any of the other forms of dysmenorrhea. It frequently consists of headache, severe, dull aching pain in the lower abdomen, back, and limbs, with an exaggeration of the usual nervous phenomena of menstruation. Women the subjects of this form of dysmenorrhea are often poorly developed and frail physically, and of a highly wrought nervous temperament. Neuralgic dysmenorrhea is not always to be regarded as belonging to the class in which we have placed it, viz., dysmenorrhea from congenital defects. It may develop in the previously healthy girl as the result of nervous tension for long periods of time. An improper and unhygienic mode of life, excessive worry, and mental strain may also act as causes. In the neuralgic form of dysmenorrhea there is no palpable lesion. If in a supposed case an associated antelexion and cervical malformation with stenosis are found, it is justifiable to conclude that in that individual instance obstruction to the menstrual outflow may partly account for the suffering.

Fliess¹ connects certain cases of dysmenorrhea with diseases of the erectile bodies of the lower turbinated bones and the tuberculum septi of the nasal cavity. His views have not found general acceptance, although a number of authors have supported him and have reported successful results in dysmenorrhea by following his plan of treating the nasal disease.

Dysmenorrhea Due to Acquired Lesions.—*Etiology, Pathology, and Diagnosis.*—Acquired dysmenorrhea, or dysmenorrhea from acquired lesions, may be a symptom of almost every pelvic disease. Endometritis, retroposition of the uterus, fibroid tumor, polyp, pelvic inflammatory diseases, and ovarian tumors may produce it.

One must not draw the line too closely between acquired and congenital lesions. For example, fibroid tumors are probably congenital, so that "acquired," as it refers to them, must be taken in the sense that they do not usually produce symptoms until the prime of life. It is also true that dysmenorrhea due to demonstrable

¹ Fliess, Wilhelm: "Die nasale Reflexneurose," Verhandlungen des Congresses für innere Medicin, Zwölfter Congress, S. 384. Wiesbaden.

² *Ibid.*: "Magen Schmerz und Dysmenorrhœa in neuem Zusammenhang," Wiener klin. Rundschau, 1895, Jahrg. ix, Nrn. 1, 2, 3, 5, 8, 9 u. 10.

changes in the ovaries may exist from the very beginning of menstruation. In such a case the ovarian disease may be congenital. The dysmenorrhea of retro-position is due to an associated endometritis or to the pressure of the uterus upon the ovaries, or to a more or less chronic congestion of the uterus. The dysmenorrhea of fibroid tumors is caused by painful contractions of the uterus produced by an irritating effect of the fibroid, or by an associated congestion of the endometrium, or by an endometritis. Inflammatory dysmenorrhea is the result of the menstrual engorgement of the diseased pelvic viscera. Ovarian dysmenorrhea results from a thickening of the ovarian capsule, cystic degeneration of the ovary, small ovarian cysts, and prolapse of the ovary.

In all of these acquired forms the pain is more or less constant throughout the period, and, except in some cases of fibroid tumor, does not resemble the labor-like pains of obstructive dysmenorrhea. The diagnosis of the particular form of dysmenorrhea in a given case is always desirable. It becomes a symptom only and does not figure in the diagnosis so soon as a gross pelvic lesion is discovered which accounts for it. Dysmenorrhea as an entity in diagnosis is mostly confined to congenital defects in the genital apparatus which do not produce a recognizable deformity, and to congenital or acquired defects in the nervous system.

Treatment of Dysmenorrhea.—*Dysmenorrhea Due to Congenital Defects.*—For dysmenorrhea which is due to an obstruction of the cervical canal, associated with an ante flexion of the cervix or of the corpus, dilatation is the procedure of choice. If the obstruction is the sole cause of the



FIG. 164.—THE WYLIE DRAIN.

menstrual pain the patient will be cured by this operation. This is not true if the dysmenorrhea is wholly or in part of the neuralgic type. Neuralgic dysmenorrhea is not permanently benefited by dilatation of the cervix. It is this type of case for which so many remedies are tried and for which in many instances nothing seems to do much good. The prognosis of the neuralgic form of dysmenorrhea is best when the patient comes under observation at an early age. Under such circumstances, if persistent attention is given to the growth and the development of the patient, the symptom may disappear. Such patients should lead an outdoor life as far as possible. Athletic exercises suited to the strength of the individual should be regulated so that they shall promote physical development.

When the patients are seen later in life and the painful menstrual flow has become a firmly rooted body habit, there is less prospect of success. Under such conditions the general health should be improved so far as possible. As the uterus is often poorly developed, the intrauterine application of the galvanic current may be tried. (See Galvanism, page 219, and Treatment of Sterility, page 245.)

Beyea (personal communication) has had excellent results, in cases of dysmenorrhea associated with a badly developed cervix, from the use of the stem pessary. After thoroughly dilating the cervix he introduces a Wylie drain (Fig.

164.) The device will usually come away of itself about the tenth day. If it does not, there is no objection to leaving it in place for several weeks, or even months. In one case Beyea allowed the pessary to remain in the uterus for four months. During the time the pessary is in position the patient performs her usual duties. A sterile water douche is taken daily. In not a single case reported by Beyea was there any untoward effect. The authors would be opposed in general to the use of a stem pessary because of the danger of infection of the uterine cavity. This is less likely to occur at the present time than in the preantiseptic days.

There are certain measures which may prove of service in relieving painful menstruation: they include rest in bed, saline cathartics, hot sitz-baths, and hot rectal injections. An ice-bag to the sacrum sometimes will give relief. The number of drugs which have been recommended and used for dysmenorrhea is legion. Tr. gelsemium, gtts. x four times daily, begun several days before the expected time of menstruation and continued throughout the period, we have found of some value in the neuralgic form of dysmenorrhea. For the relief of severe pain, phenacetin alone or in combination with hyoscyamus and codein may be tried. In certain cases of dysmenorrhea nothing short of opium or one of its alkaloids can give relief. In cases where the suffering is so great that opiates are necessary it is preferable to give the drug by mouth and in combination with strontium bromid. The resort to opium in such cases carries with it the danger of acquiring the opium habit. The physician must guard against this, or avoid the use of opium. In some cases general massage given between the periods is of service.

Dysmenorrhea Due to Acquired Lesions.—It is hardly necessary to discuss the treatment of that form of dysmenorrhea which is but the evidence of a gross pelvic lesion. When such a lesion is present the dysmenorrhea should be treated only in conjunction with and as a part of the disease. Dysmenorrhea is a symptom whose cause, in some cases, is a matter of speculation. In such a case we are obliged to employ measures to relieve the menstrual suffering and study the case carefully in order to determine its nature. As has been said by Kelly (*loc. cit.*), quite often the patients are treated in vain for the symptom while the lesion producing it is overlooked or neglected. Dysmenorrhea due to ovarian disease, "ovarian dysmenorrhea," as it is sometimes called, requires special discussion because it is frequently confused with neuralgic dysmenorrhea. The title, "ovarian dysmenorrhea," deserves little respect except in the broad sense that gross lesions of the ovary may cause this symptom. Oöphorectomy for dysmenorrhea, in the absence of gross lesions, has frequently substituted one form of neuralgia for another, and in young women has added the discomforts attendant upon the artificial menopause to the neuralgic symptoms. "Ovarian dysmenorrhea" (really neuralgic dysmenorrhea) in women not the subjects of ovarian disease is a neurosis and should be treated by medical and by hygienic measures. In cases believed to belong to this class, consultation with an expert neurologist and with an expert gynecologist should be had.

Matrimony and childbearing often prove to be the natural cure after the failure of the physician's best efforts.

Membranous Dysmenorrhea.—*Etiology, Pathology, and Diagnosis.*—Membranous dysmenorrhea is said to exist when there is a discharge from the uterus, at the menstrual period, of portions of the uterine mucosa, accompanied by severe, cramp-like, paroxysmal pain. According to Hausmann,¹ Morgagni first observed this condition in 1723.

The entire superficial portion of the endometrium may be discharged in one piece. In such a case the tissue presents a cast of the uterine cavity and shows the position of the tubal ostia and of the internal os by depressions upon its surface.

Usually the mucosa is thrown off in several portions. With the endometrial tissue there is often a considerable amount of blood-clot. The diagnosis of membranous dysmenorrhea is not justified without microscopic examination of the discharged fragments. Very often what is thought to be endometrial tissue proves to be nothing but fibrin. The histologic structure of the endometrium, in the case of true membranous dysmenorrhea, is said by Gebhard (*loc. cit.*) invariably to present the picture of an interstitial endometritis in which the stroma is much swollen by an exudate, in part cellular, in part fibrinous.

The surface epithelium, for the most part, is well preserved. The glands are few and show a peculiar jagged course which is not due to proliferation, but to the mechanical injury they have suffered during expulsion of the fragments. The membrane usually possesses a considerable thickness, the separation having occurred in the deeper layers. Large cells, reminding one of the decidual cells of pregnancy, are seen. The number and the size are not such as to lead to any confusion with the decidua of pregnancy.

Treatment.—The treatment of membranous dysmenorrhea should be that of its cause, viz., chronic endometritis. For the pain itself, the measures described on page 238 should be employed.

HYGIENE OF ADOLESCENCE.

Up to the time of puberty a girl is naturally quite active, indulging in outdoor games almost as much as a boy. If this is not true, it is more because of natural inclination than of direction or of environment. The advantages of an active early life need not be discussed here. When menstruation begins and a girl passes to young womanhood, there is more or less change in her inclinations. This change, if it lessens the disposition to indulge in physical exercise, may lead to an unhygienic mode of life. A healthy, active, robust girl will pass through her period of adolescence from puberty until adult life or marriage without any serious notice of her sexual development. Menstruation will have few subjective symptoms. It will come and go and the young woman will need to vary her routine of living in no way because of it. This is the story of the robust, healthy girl of healthy parentage who has not been injured by faulty habits of dress, too little exercise, badly chosen diet, or faulty personal hygiene. For such a person little

¹ Gebhard, C.: "Pathologische Anatomie der weiblichen Sexualorgane," Leipzig, 1899.

advice is needed. The following discussion of the hygiene of this period of life, therefore, applies to those who, by heredity or by environment, tend to become the subjects of the various disorders we have previously discussed.

Exercise.—While it is unnatural for a girl, after puberty, to be as active as a boy, the importance of muscular exercise proportioned to her strength can scarcely be overestimated. The muscles are the seat of a large part of the metabolic activity of the human economy. Heat production, the expenditure of energy, the proper circulation of the blood, and the excretory activity depend very largely upon muscular contractions.

The proper exercise of the muscular system is not found in the duties of the household nor in the demands of the school-room. The young woman should be urged to indulge in all suitable forms of outdoor sports. Walking, tennis, basket-ball, the bicycle, rowing, swimming, skating, horseback, will all assist in procuring and maintaining a healthy muscular development. If the opportunity for such exercise is not at hand, then the use of dumb-bells or of Indian clubs is advisable.

School.—The hours for school and for study should be so arranged that a part of each day is reserved for healthful exercise, preferably out of doors. Excessive study is not so injurious as a lack of physical activity. Although education is desirable for all, and a necessity to many, it is a mistake to suppose that mental development can be attained without regard for the physical status. Healthy mental activity bears a direct relation to the physical well-being of the individual.

Dress.—According to Dudley,¹ there are three principles to be observed in the hygienic dress of woman:

1. Even distribution, for uniform protection against cold and wet.
2. Freedom from waist constriction.
3. Freedom from traction.

Even Distribution.—Dress, as a rule, is notoriously uneven in distribution. With little protection about the neck and arms, with thin shoes, thin stockings, and loose skirts protecting the legs and feet, the abdomen, hips, and upper part of the thighs are "swathed and compressed in a torrid zone of whalebone, corsets, belts, steels, skirts, and other cumbersome material."

Waist Constriction.—Constriction of the waist is inevitable when the typical corset is worn and the skirts are supported by bands which fasten about the waist. Such constriction, and the immobilization of the abdominal wall which the corset produces, interfere with respiration and cause a weakening or an atrophy of the abdominal muscles. When the woman bends forward in the sitting position, and this is frequent in typewriters, seamstresses, clerks, and students, even the loosely worn corset excites great pressure on the lower abdomen. As the ovarian veins empty into the vena cava and the renal vein at about the point of greatest waist constriction, the long column of blood which they contain is dammed back.

¹ Dudley, E. C.: "Diseases of Women," Phila., 1898.

The consequence of this is a passive congestion of the pelvis and its train of evils.

Freedom from Traction.—The muscles of the lower abdomen, back, and thighs become in time relaxed and weak from the more or less constant drag upon them which the conventional dress necessitates; the trunk muscles become weak from lack of use in maintaining the trunk upon the pelvis, which function is largely performed by the conventional corset.

The hygienic form of dress is designed to overcome all of the objections which have been noted. The undershirt and the drawers should be made in one piece—a union suit. The material may be cotton, wool, or silk, or any mixture of these. The weight of the garment, the length of the sleeves, etc., should be varied to suit the season and the hour. Dudley suggests equestrienne tights to take the place of the heavy woolen underskirt which is sometimes worn in cold weather. The corset should be light and flexible, and conformed to the woman's body. If a stiff corset is insisted upon, the so-called straight front variety is much less injurious than the old-fashioned corset, because it does not constrict the waist. Underskirts and pantalettes should be buttoned to an underwaist. The skirt of the dress should be supported from the shoulders, either by supplying it with shoulder-straps or by making it in one piece. Compression and constriction at the waist are to be carefully avoided.

Diet.—The food should be plain and wholesome. Tea, coffee, sweetmeats, condiments, and alcoholic beverages of any kind, if used at all, should be taken in small quantities. Care should be observed lest the abuse of desserts, cake, pastry, candy, etc., rob the individual of a normal appetite.

Sleep.—If the diet and the hours of exercise and study are well regulated, there will be no tendency to insomnia. Moderate physical fatigue is conducive to refreshing sleep.

Hygiene of the Menstrual Period.—In a robust woman there is no need of any change in the routine of daily life at the menstrual period. For those who are indisposed at that time, rest and quiet are desirable. During the menstrual period, with such women, exposure to cold and dampness should be avoided. Cold baths should be discontinued. For esthetic reasons, tub baths are intermitted by most women during menstruation and sponge baths are substituted. Many athletic women use cold baths, but for the average woman such exposure is apt to produce a suspension of the menstrual flow.

MENOPAUSE.

The cessation of the menstrual periods takes place between the fortieth and the fiftieth years. Generally speaking, the earlier menstruation begins, the later it ends, and vice versa. The menstrual flow, as a rule, does not stop at once, but gradually becomes less frequent. Not uncommonly several periods are missed and then

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menstruation may be normal again for several months. Less frequently menstruation ceases abruptly. During the period of cessation certain subjective symptoms occur, which may be taken as an evidence of the alteration in metabolism which the economy of the woman must necessarily undergo on account of the abrogation of the intricate processes of ovulation and menstruation. These symptoms are apt to occur at the regular time of the menstrual flow and are somewhat analogous to the *molimina menstrualia* already described. The patient suffers from general or localized sensations of heat and cold and attacks of profuse perspiration; she is nervous and irritable, has headache, and is disposed to depression of spirits. In the robust, healthy woman the symptoms are of little consequence; in the neuro-pathic they give rise to much complaint.

The Management of the Menopause.—Healthy women do not require any special care at the time of the menopause. When the subjective symptoms incident to this period of life are so exaggerated as to be painful, nerve sedatives may be used. In some of the worst cases it may be necessary to employ the typical or the modified rest cure to improve the tone of the nervous system.

The most important and significant symptom occurring about the time of the menopause pertains to an increase of the menstrual flow. A return of the flow after it has ceased, an increase in the amount of blood lost at a period, and the occurrence of bleeding between the periods, are symptoms which may have the greatest import. The appearance of a leukorrheal discharge, or the exaggeration of a previously existing one, are also important symptoms. When any such symptoms present themselves in a woman who is nearing or who has passed the change of life, an immediate and a thorough examination is demanded. If, after the usual methods of examination, malignant disease of the cervix or of the corpus uteri has not been excluded, curetage of the uterus or excision of a section of the cervix should be performed immediately and a specimen sent for examination to a person who has been trained in gynecologic pathology. It is a generally accepted fact at the present time that it is only by an earlier diagnosis of the malignant diseases of the uterus that their prognosis can be improved.

Premature Menopause.—Women in the prime of life will occasionally suffer a suspension of their menstrual periods. In many of these cases a great increase in adiposity precedes the diminution or the suppression of menstruation; in others, the ovaries atrophy. (See Amenorrhea, page 226.) Montgomery¹ reports a case occurring in a woman aged twenty-seven. She had been married four years (no pregnancies). Her menstrual flow continued to be regular, but gradually became less in amount and of shorter duration, until at last it ceased altogether. At marriage the patient weighed 98 pounds; four years later her weight had increased to 170 pounds. At that time she seemed in perfect health and had no aches or pains of any sort. In such a case the excessive increase of adipose tissue results in the cessation of the menstrual function, possibly from changes in the ovary itself which interfere with the maturation of the ovum and result in a cessation of ovulation.

¹ Montgomery, E. E.: "Premature Menopause," *Med. News*, Phila., 1894, vol. lxxv, p. 461.

Treatment.—There is no treatment which will serve to restore the menstrual function after it has once been abrogated by ovarian atrophy. Cases in which a cessation of the menses depends upon the condition of the general health, etc., and in which the menstrual periods recur after appropriate treatment, are spoken of as amenorrhea.

Artificial Menopause.—This follows removal of the ovaries and is usually the result of an operation which is undertaken to save the woman's life or to eradicate pelvic disease which makes her a chronic invalid. In the great majority of cases, in women past the age of thirty, the symptoms are exactly those of the normal menopause, except that the menstrual flow is stopped abruptly.

In highly neurotic women the most exaggerated complaints may be made. A nervous affection characterized by a loss of nerve tone and by mental distress may follow any operative procedure. It is akin to traumatic neurasthenia or "railway spine." This condition is sometimes accountable for the nervous symptoms which follow removal of the ovaries. In younger women the influence of such an operation is more pronounced. In married women sexual feeling is not much, if at all, affected by it. A complete radical operation in a married woman may increase the sexual impulse, because the removal of diseased tissues makes sexual intercourse painless. Some women who greatly fear impregnation do not perform the sexual act normally, and for this reason do not experience sexual gratification. In such cases, if from intercurrent disease removal of the ovaries becomes requisite, and the possibility of impregnation is removed, the sexual act may be more acceptable than before. To every woman who desires children, the knowledge of an incapacity for motherhood brings a certain degree of regret, measured by the intensity of her desire. The personal equation influences all of the symptoms which may accompany the artificial menopause. Removal of both ovaries is to be scrupulously avoided, whenever possible, up to the age of thirty-five. After that time its avoidance is not so important.

Treatment.—In the average woman the artificial menopause presents no more unpleasant features than are incident to the normal menopause. In the neurotic and in the young the subjective symptoms may be very distressing. The symptoms are supposed to depend upon the loss of the internal secretion of the ovaries.

Fraenkel's¹ interesting experiments indicate that the corpus luteum of the ovary is an actively secreting glandular structure, and that it supplies the so-called internal secretion of the ovary. He has prepared for therapeutic use a powder made from the corpora lutea of the cow. This he gives in doses of 0.3 gm. three times daily, and in fourteen women who were suffering from an artificial menopause he had great success in alleviating or preventing the nervous symptoms. Ovarian extract, as obtained in the shops, has apparently given favorable results in our hands in some cases. On certain women who knew the nature of the remedy it seemed to act by suggestion.

¹ Fraenkel, Ludwig: "Die Function des Corpus luteum," Archiv f. Gynäk., Bd. lxxviii, H. 2, S. 438.

STERILITY.

Etiology and Pathology.—A woman is said to be sterile when conception does not occur within three years after marriage. This is a purely arbitrary statement and does not obtain if any means have been adopted to prevent impregnation. A woman may cease to have children after one or more impregnations, because of acquired disease, but this is not usually spoken of as sterility. "One-child sterility" was first mentioned by Noeggerath,¹ and is a state of barrenness which depends upon an ascending gonorrheal affection occurring during the first puerperium. Sterile marriage, in a certain proportion of cases, may be laid at the door of the husband; and no woman, in the absence of palpable lesions, should be considered barren until the man has been found entirely healthy.

Sterility on the part of the woman may depend upon imperfect development, inflammatory disease and its results, or upon some functional or mechanical derangement whereby the sexual act is faulty, or the male and the female elements are prevented from meeting.

In **developmental sterility** quite frequently the defect is not extensive, and only in rare instances does it consist of an entire absence of a part or of the whole of the genital tract. Usually it is due to an arrest of development,—a persistence of the infantile or of the fetal type. The condition may be associated with an imperfect development of the secondary sexual characteristics. It occurs also in those who have a normal external appearance; and it is sometimes associated with a robust carriage and a large masculine frame and pelvis.

The developmental defects which prevent impregnation, or render it difficult, are: *hypoplasia of the ovaries* (few and imperfectly formed ova); *fetal type of Fallopian tube* (wherein the tube is long and very much twisted); *diverticula* (ovum arrested in its passage toward the spermatid particle); *infantile or fetal type of uterus* (imperfect embedment of a fertilized ovum); *stenosis of the cervical canal* (preventing ingress of the spermatozoa); *elongation of the cervical canal or flattening of the vaginal fornices* (seminal lake does not bathe the external os, or the semen escapes from the vagina directly after coitus); *malformation of the vagina or external genitalia* (forming a barrier to copulation or to the entrance of the spermatozoa).

Sterility which depends upon pelvic inflammatory disease, or its result, is found when there are adhesions which close the abdominal ostia of the Fallopian tubes, or produce enough kinking of the tubes to obstruct their lumen. Dense adhesions of the ovaries, preventing rupture of the Graafian follicles, have a similar result. Cervical catarrh, or endometritis, may prevent conception by a discharge which is inimical to the spermatozoon and to the embedment of the fertilized ovum. It has been asserted that 80 to 90 per cent. of all cases of sterility in women is due to gonorrhea. This is an error, says Bumm,² at once evident from the fact that

¹ Noeggerath, Emil: "Die latente Gonorrhoea in weiblichen Geschlecht," Bonn, 1872.

² Bumm, E.: "Ueber Behandlung u. Heilungsaussichten der Sterilität bei der Frau," Deutsche med. Wochenschr., Bd. xxx, Nr. 48, S. 1756.

from 15 to 20 per cent. of women in maternity hospitals suffer from chronic gonorrhea which they acquire before pregnancy, and in spite of which they repeatedly conceive. Although gonorrhea may play the greatest rôle in masculine sterility, it is otherwise in women. Two-thirds of the sterility in women depends upon faulty development. The other third comprises acquired sterility in which gonorrhea plays a prominent part.

Mechanical causes, preventing the ingress of the spermatie particles, include anteflexion and retroflexion of the uterus and fibroid tumor or adenomatous polyp which obstructs the cervical canal.

Functional sterility may be due to vaginismus, which prevents satisfactory intercourse, to incompatibility between the male and the female, and to any functional disarrangement which renders the sexual act faulty in any of its details.

Treatment.—The treatment of sterility is as varied as the lesions which produce it. Little, perhaps, can be done by local treatment for sterility which is the result of pelvic adhesions or of gross malformations of the genitalia. Except in such cases, however, local measures may be serviceable, either alone or as adjuncts to an operation. Given a case of sterility, the potency of the husband should be confirmed before any treatment of the wife is begun.

If retroposition of the uterus exists, it should be corrected if possible and the organ held in place by means of a pessary. If the retroposition is associated with adhesions, nothing but operation will suffice. One of the authors¹ has drawn attention to the fact that occluded, tightly adherent, and slightly enlarged tubes may be overlooked or only suspected; and that as a consequence patients will be promised too much and be subjected to utterly useless and perhaps (under the circumstances) harmful treatment in the hope that thereby the sterility may be cured. This aspect of the question should engage the attention of the physician, and sterile women having a history of pelvic peritonitis, and especially having the evidence of the condition in the shape of pelvic organs fixed by adhesions or with lessened mobility, should be promised but little, and above all should not be subjected to treatment for uterine or vaginal lesions until disease of the tubes has been positively excluded. Exploratory celiotomy is justifiable here for diagnosis when the bimanual examination does not make clear, nor yet exclude, the existence of the occlusion of the tubes, or when pregnancy is desired and treatment addressed to the uterus is otherwise indicated.

When the occlusion of the tubes is due to angulation by adhesions, celiotomy with separation of the adhesions may effect a cure. When bilateral pyosalpinx, hydrosalpinx, or even marked salpingitis is present, the chances of curing the sterility by plastic operations on the tubes is not great. When the adnexa are healthy and well developed and the uterus is small, the galvanic current in the hands of Bumm (*loc. cit.*) has given happy results. The positive electrode is placed upon the abdomen; the negative electrode is passed into the uterus.

¹Noble, C. P.: "Salpingitis Considered in its Relation to Pregnancy and the Puerperal State; Salpingitis in its Relation to Sterility." Trans. Amer. Gyn. Soc., 1891, vol. xvi, p. 480.

A weak current up to 50 milliamperes, for five minutes, is used. This galvanization should be given two or three times weekly and after each treatment the uterus should be lightly massaged. Bumm has seen the uterus enlarge 1.5 cm. in three months under this plan of treatment. He has treated within five years 12 women for infantile development of the genitalia; 5 were relieved of dysmenorrhea; of these, 3 were married and all of the three conceived subsequently; in 7 there was less dysmenorrhea but no increase in the length of the uterine cavity. If the uterine body does not enlarge under this treatment he says no plan will be of avail and no operation to correct a flexion should be done. For stenosis of the internal or of the external os, forced dilatation of the cervical canal should be employed and repeated, if necessary, to maintain a patulous canal. Every gynecologist of experience has had repeated successes by this method. When the cervix is long and conical and the external os is narrow, and especially when this is accompanied by an ill-developed vaginal vault, the cervix should be amputated by a neatly performed operation in order to restore the contour of the cervix to the normal. Another plan is to split the posterior lip of the cervix as far back as the vaginal fornix: the mucosa of the cervical canal is then sewed to the mucosa of the vaginal surface of the cervix. Dudley's (*loc. cit.*) operation may be performed. When the vaginal vault is shallow it should be systematically tamponed, larger-sized tampons being substituted from time to time until the vaginal vault has been stretched and given its natural dome-like shape.

Sterility from gonorrhea which is confined to the urethra, the vulvovaginal glands, and the cervical canal, is not a hopeless condition. Local applications to the urethra, applications to or excision of the vulvovaginal glands, and curetage or amputation of the cervix may cure both the gonorrhea and the sterility. Rest before, during, and after the menstrual periods is indicated in such cases.

At times sterility is due to chronic endometritis or to glandular hypertrophy of the endometrium. In such cases curetage is indicated.

In pelvic congestion, when the cervix and the vagina are bathed with leukorrheal discharge, the systematic use of glycerite of boroglycerin tampons may restore the parts to the normal and permit of conception. If the vaginal discharge is very acid, a douche of sodium bicarbonate solution, $\frac{3}{4}$ ij to the quart, should be taken previous to intercourse.

Frequent coitus should be discouraged; impregnation is more probable when the sexual act is performed at less frequent intervals, and especially before and after the menstrual periods.

VULVITIS.

Etiology and Pathology.—The vulva is naturally well protected against inflammatory affections. This fact results from the structure of the vulvar mucosa, which more or less resembles the skin, and from a bactericidal action of the secretion with which its inner parts are bathed. The epithelium of the vulva is of the stratified squamous variety, and upon the larger labia and

the outer surfaces of the lesser ones closely resembles the ordinary cutaneous surface of the body. Upon the inner surface of the smaller labia the epithelial covering becomes more delicate, so that at the vestibule it closely resembles that of the hymen and vagina, with which it is continuous. This part of the vulva is moistened with a secretion which comes from the vagina and possesses the same reaction and bactericidal properties as the vaginal secretion. Numerous bacteria are found here besides those common to the vaginal secretion. Very few are pathogenic. In the adult the protection which the vulvar epithelium affords against infectious organisms is greater than in the child, because the mucosa is thicker and tougher. It is a matter of common clinical observation that primary vulvitis is much more common in the child than in the adult, the more delicate epithelial surfaces of the child being less resistant to bacterial invasion. Except in the young, therefore, primary vulvitis is infrequent. When the natural protection against infection in the adult is weakened,—in other words, when from more or less continuous irritation the epithelium becomes macerated, when the vaginal secretion becomes altered so that it loses its bactericidal properties, when there is repeated infection from a coexisting and neighboring lesion,—then vulvitis is quite likely to occur. The causes of vulvitis include gonorrhea, uncleanliness, diabetic urine, irritating discharge from a lesion higher in the genital tract (vesicovaginal fistula, carcinoma), thread-worms, the discharges in typhus fever and dysentery, too frequently repeated sexual intercourse, and masturbation. Gonorrhea is the most usual cause. In the child gonorrheal vulvitis is highly contagious, passing from one patient to another through the medium of bed-clothing, napkins, the hands, etc. In the adult gonorrheal vulvitis is less frequent and is usually but a part of an infection involving the urethra and Bartholin's glands. The severity of vulvitis will depend upon the cause and the degree of irritation. In vulvitis from irritating discharges, thread-worms, or uncleanliness the symptoms are less violent, as a rule, than in the gonorrheal form. In vulvitis the parts are reddened and swollen and covered with a secretion which varies according to the nature and the intensity of the infection. In the milder forms the parts are bathed in a thin muco-purulent secretion; in the more severe forms the discharge is largely purulent and the inflammatory symptoms are more marked. There may be great edema of the structures composing the vulva. Inguinal adenitis may accompany gonorrheal vulvitis.

Symptoms.—The symptoms of vulvitis vary from a sense of discomfort and chafing to an actual burning pain. They are exaggerated upon locomotion. Upon appropriate treatment, the inflammation of the vulvar mucosa in general subsides, while the infection remains localized in the urethra, vulvovaginal, or vestibular glands. In certain cases of vulvitis the sebaceous glands and the hair-follicles are especially infected. They become distended with pus and produce a vulvar acne to which the name follicular vulvitis (furunculosis) has been applied (Gebhard, *loc. cit.*). In puerperal women streptococcus vulvitis sometimes occurs. This disease, which results from the infection of abrasions or wounds of the vulva,

causes considerable necrosis and the formation of an ulcer with infiltrated borders and a gray or a discolored brown base. The favorite seat for this ulceration is the frenum or the perineal body; next the points to the right and to the left of the introitus vagina, where the subcutaneous tissues are most firmly attached to the descending rami of the pubes. This condition is frequently spoken of as diphtheritic, even though it has nothing to do with the Klebs-Loeffler bacillus. Streptococcus vulvitis may occur also after scarification of the vulva, and in young children in association with a streptococcus infection of the umbilicus.

Real diphtheria of the vulva does occur in young children the subjects of pharyngeal diphtheria. Bumm¹ has reported a case of puerperal ulceration of the vulva caused by the Klebs-Loeffler bacillus.

A gonorrheal phlegmonous infiltration of the subcutaneous connective tissue is occasionally observed. This occurs, as a rule, only in the puerperium and results from the infection of more or less deep abrasions or wounds of the vulva.

Noma, or gangrene of the vulva, is said to be seen in young children who are greatly reduced in strength and who live in filth and poverty.

Treatment.²—In the simple forms of vulvitis which depend upon uncleanness, thread-worms, diabetic urine, and irritating discharges, the parts should be bathed several times a day with a saturated solution of boric acid; or with bicarbonate and with baborate of soda, of each 1 dram to a pint of water. If there is a vaginal discharge which possibly has to do with the vulvitis, a vaginal douche followed by a tampon is indicated, and this should be repeated often enough to keep the vulva free from the irritating excretions. The contiguous vulvar surfaces should be thoroughly dried after each cleansing and dusted with a powder consisting of equal parts of powdered burnt alum and acetanilid. If the patient has diabetes, she should receive general treatment, and urination should always be followed by irrigation, drying, and dusting of the vulva with borated talcum. Occasionally an ointment is more soothing than a dusting-powder. For this purpose either a 10 per cent. boracic acid ointment or a 5 per cent. carbolic acid ointment is serviceable.

The treatment of acute gonorrheal vulvitis consists essentially in repeated gentle cleansing of the inflamed parts and the application of antiseptic solutions. It should be remembered that the gonorrheal form, especially in children, is very infectious, and care should be taken lest any of the gonococcus pus is transferred to the eyes or to another patient. In the acute stage of primary gonorrheal vulvitis local treatment should be confined to the vulva, and under no circumstances should vaginal douches be employed.

The vulva should be cleansed three or four times daily with a warm solution of bichlorid of mercury 1 : 10,000, or an alkaline solution of bicarbonate of soda and baborate of soda, of each 1 dram to a pint of water. The solution is either poured

¹ Bumm: "Ueber Diphtherie und Kindbettfieber," Zeitschr. f. Geburtsh. u. Gynäk., Bd. xxxiii, S. 126.

² The authors wish to express their thanks to Dr. Wm. B. Small for valued assistance in the preparation of the sections dealing with the treatment of the venereal diseases.

over the vulva or applied by means of cotton balls held in dressing forceps. After all of the discharge has been washed or wiped away, strips of gauze soaked in a 25 per cent. aqueous solution of argyrol should be placed between the lips of the vulva.

If the pain is great, warm applications of lead water and laudanum should be made constantly. After the discharge begins to subside, if there is great itching and pain, 1 per cent. of powdered burnt alum should be added to the lead water and laudanum. General measures include rest in bed, saline laxatives, and refrigerant diuretics (potas. carbonate, potas. bitartrate). (If inguinal adenitis develops the condition should be treated as described under the Treatment of Chancroids, page 253.) After the acute inflammatory symptoms have subsided strong antiseptic solutions may be applied directly to the vulva. Argyrol,¹ 25 per cent.; nitrate of silver, gr. xxx-f3j; bichlorid of mercury, 1:1000; solutions of formaldehyd up to 1 per cent. At this time attention should be turned more immediately toward the urethra and the vulvovaginal glands (as described on pages 310 and 329).

After the use of antiseptic applications, when the acuteness of the attack has subsided, the apposed surfaces of the vulva should be kept separated and well dusted with equal parts of tannic acid and bismuth subnitrate, or with some other dusting-powder. The treatment of streptococcus vulvitis, which occurs almost exclusively in the puerperium, is an obstetric subject and will not be discussed here. Real diphtheritic vulvitis should be treated by the use of antitoxin and the same general and local measures which are adopted for diphtheria elsewhere.

CONDYLOMATA ACUMINATA.

Etiology, Pathology, and Symptoms.—Condylomata acuminata, or venereal warts, are papillary outgrowths which occur upon the external genitalia, vagina, and cervix. They occur either as discrete outgrowths or they may coalesce, forming cauliflower or mulberry-like excrescences, covering the entire vulva or a part of it. The warts when discrete usually have more or less of a pedicle; when they are confluent they arise from broad surfaces and are sessile. Their color depends upon the thickness of the epithelial layer and their vascularity. If the epithelium is intact they are of the same color as the surrounding skin; if it is macerated or if the growths are very vascular they are purplish red in color. The growths are produced, as a rule, by the irritation of gonorrheal or other discharges which keep the parts constantly moist. The irritation of secondary syphilitic lesions may cause them. They are frequently developed during pregnancy as a result of the congestion and the nutritive stimulus incident to that state. Although they usually occur either as a result of the diseases mentioned or from uncleanness, they may occur in healthy women whose personal hygiene is above reproach. There is usually an offensive and highly irritating excretion from venereal warts; the more vascular the vegetations, and the thinner their covering

¹ Linen stained with argyrol may be cleansed by immersion in a 1:500 solution of bichlorid of mercury.

of epithelium, the greater the discharge. Venereal warts give rise to a sense of discomfort or pain, especially when walking. The outgrowths may become the seat of inflammation.

Treatment.—The parts should be cleansed frequently with a solution of bichlorid of mercury, 1 : 2000, followed by normal saline solution. After careful drying a dusting-powder of equal parts of powdered tannic acid and lycopodium should be used. (Powdered tannic acid and lycopodium are extremely light in weight; not more than a dram of each should be ordered at a time by prescription.)

If the growths interfere with walking the labia may be separated by means of absorbent cotton held in place by a T-bandage. Under this plan, in mild cases, the vegetations disappear. Usually it will be necessary to destroy the growths by curetment and the application of nitric acid. A sharp curet should be used and care should be taken not to open up planes of healthy tissue or healthy lymphatic channels. The surrounding parts should be smeared with vaselin before the acid is applied. Several applications are better than one very extensive application.

Schein¹ has recently employed refrigeration in the treatment of about 30 cases of condylomata acuminata. The entire surface, base and pedicle, is frozen by means of an active stream of ethyl chlorid. The surrounding parts are protected by means of dry gauze or cotton. This refrigeration leads to such a high grade of thrombosis and stasis in the vessels of the growth that necrosis occurs and the tumor falls off in the course of several days. This treatment is applicable to any case of condylomata acuminata. As a rule, in single pedunculated tumors one application is sufficient. Sometimes Schein has used as many as six applications. The patient during the application complains of a sticking, cold feeling, and afterward, for some minutes, of a continual burning pain. The pain, however, is always bearable and frequently it is very slight. The advantage of the method is that it is quick and clean; there is no loss of blood, no preparatory treatment, and it can be used at any time. The successful treatment of venereal warts often requires a resort to operation.

SYPHILITIC LESIONS OF THE VULVA.

Pathology and Diagnosis.—The most frequent seat of a chancre of the genitalia in the female is the labia majora; thereafter it is the fourchette, nymphæ, clitoris, and mons veneris, in the order named. White and Martin² believe that the primary sore in women occurs more often on the cervix than is usually supposed, —the part being inaccessible to view and the primary sore often causing no symptoms *the lesion is not observed*.

Gebhard (*loc. cit.*) says, in speaking of the primary inoculation of syphilis upon the vulva, that after the abrasion where the infection has gained entrance

¹ Schein, M.: "Die Behandlung des Condyloma acuminatum mittels Erfrierung," Wiener klinisch. Wochenschr., vol. xviii, Nr. 5.

² White, J. William, and Martin, Edward: "Genito-urinary Surgery and Venereal Diseases," Phila., 1905.

has healed (and this often happens without any inflammatory reaction) there occurs beneath the intact epithelium a more or less wide-spread dense infiltration. This begins with an arteritis in which, first, the adventitia is infiltrated, then the intima is involved, and finally the vessel may be obliterated. Through increasing infiltration and necrosis of the tissue the epithelium over it becomes broken and produces an erosion. On the clitoris and the smaller labia there is usually a circumscribed fixed induration; on the greater labia the structures become edematous and hard and take on a peculiar brownish-red color. As in the male, the initial lesion of syphilis may be of several varieties.¹ The chancrous erosion occurs in a large number of the cases; it is superficial, round or oval, has a dusky red areola, and a polished raw surface in the center of which there is a gray false membrane discharging a small quantity of serosanguineous fluid. The induration begins a week after the lesion appears and is usually parchment-like; it may be nodular.

The chancre may be deeper, involving the true skin, and in its worst forms the subcutaneous tissues (known in such a case as the chancrous ulceration). The chancrous ulcer may be superficial or deep; it has sloping edges, and is covered with a gray false membrane and serosanguineous discharge. The initial lesion of syphilis often takes the form known as the indurated papule; the latter consists of a hard, raised, dusky red tubercle, sharply defined from the surrounding tissues, having a dry surface, and frequently encrusted with layers of exfoliated epithelium.

Chancres are modified by inflammation from a simple infection (bubo may occur); by chancroidal inflammation, papillary growths, conversion to a mucous patch, phagedena, and gangrene.

In the case of infection with chancroid and syphilis at the same time, there may be in very rare instances first a healing of the chancroid before the chancre appears; the incubation of chancroid being but a few days or at most a fortnight. Commonly the chancroid persists and forms a spreading, punched-out, inflamed, sloughing ulcer, which becomes gradually developed in a hardened infiltrate. In place of being acquired at the same time, the chancroidal virus may be inoculated on a well-developed chancre; the result of this is a chancroidal ulceration. The only local thing remaining to suggest chancre under these circumstances is the induration. If the chancroid spreads rapidly it may cause sloughing of the indurated area; this leaves no local sign suggesting syphilis. Or the syphilitic virus may be inoculated on the chancroid; the latter then pursuing its course unaltered except for the formation of an induration. The sore resulting from the inoculation of syphilis and chancroid at the same spot is called a mixed chancre. The chancre loses its induration as secondary symptoms develop; it may become covered with a gray false membrane and present all of the characteristics of a mucous patch.

In the secondary stage mucous patches (*condyloma latum*) appear upon the vulva as broad, flat elevations, which have a moist surface in consequence of transudation. Through decomposition of this excretion, superficial ulceration readily occurs.

¹ The description of the syphilitic lesions of the vulva has been largely compiled from White and Martin (*loc. cit.*).

The papillary bodies of the skin are commonly hypertrophic; the vascular and nerve-bearing papillæ reach an excessive height and project under the overlying epithelium in the form of small sharp points, from which the surface takes a raw fissured appearance. Usually there are a number of condylomata; they very often affect surfaces in apposition and such as are subject to the irritating influences of heat and moisture. There may be associated with mucous patches an abundant outgrowth of venereal warts. These are due to irritation and not to any specific virus. The secretions from these condylomata or mucous patches are the chief sources of infection with the syphilitic virus.

Relapsing induration¹ (pseudo-chancrè induré, chancrè redux) at or near the site of the primary syphilitic sore may occur during the first or second year of the disease. Two varieties are recognized—superficial and deep. The first resembles closely the true chancre; it has an elevated, smooth, ulcerated surface. The deep form is commonly located on the labia majora and simulates a small fibroid, freely movable, and not adherent to the mucous membranes. It may attain the size of a hen's egg; it causes no pain or inconvenience. Traumatism or infection may lead to abscess formation with the formation of a very indolent ulcer, which resists all treatment unless the correct diagnosis of the condition leads to proper therapeutics. (In this condition the inguinal glands are not enlarged.)

Gumma of the vulva is rare. It usually develops in the labia majora and has a tendency to break down and to suppurate.

Treatment.—General treatment should not be started until the diagnosis of syphilis is made sure by confrontation or by the appearance of the secondary lesions. When this occurs the usual treatment of syphilis, which need not be detailed here, should be instituted. Locally—in order to escape the complications of chancre noticed above—the strictest cleanliness should be observed about the parts. They should be frequently cleansed and dusted with a powder consisting of equal parts of acetanilid, boric acid, and calomel. A chancre should never be cauterized unless it becomes phagedenic. A careful examination should always be made of the cervix in order to detect the possibility of a complicating lesion (chancroid) of that part. Mucous patches should be painted with nitrate of silver, gr. xxx-℥j, and dusted with iodoform, aristol, or subiodid of bismuth. The strictest cleanliness should be maintained with vulvar douchings, as recommended under the treatment of chancroids, and the labia should be kept apart with cotton.

CHANCROIDS.

Pathology and Diagnosis.—Vulvar chancroids are found, as a rule, upon the parts of the vulva directly surrounding the vaginal orifice. They may occur also on the cervix. The course of chancroid in women is in general more serious and troublesome than in men. This is due to the fact that the vulvar parts are

¹Taylor, Robt. W.: "A Practical Treatise on Genito-urinary and Venereal Diseases and Syphilis," Phila., 1904.

more or less constantly in apposition and are subject to the irritation of urination, menstrual discharge, leukorrhea, and the friction incident to walking. Secondary infections are quite common and may be indefinitely repeated unless careful attention is given to prevent contact with healthy surfaces and to maintain absolute cleanliness.

The incubation period of chancroids is usually five to six days, occasionally twelve days. The ulcerations have a punched-out appearance and the edges are undermined. The base shows no marked induration, and is covered with granulations which have a purulent infectious discharge.

Treatment.—As soon as a diagnosis is made the ulcerations should be thoroughly cauterized so as to destroy all of the chancroidal infection at once and convert them into healthy granulating surfaces. A full investigation of the cervix and the vagina is necessary and the cauterization must include every chancroidal ulceration.

A local anesthetic, such as cocain, may be sufficient, but if the extent of the ulceration renders this unlikely a general anesthetic, such as nitrous oxid, ethyl chlorid, chloroform, or ether, should be given and the ulcerations thoroughly burned out with pure carbolic acid or with nitric acid. The actual or electric cautery is apt to produce too much sloughing and is therefore not advisable. The vagina and the vulva are then thoroughly douched with bichlorid solution, 1:2000, thoroughly dried, and a dusting-powder of iodoform is applied. The objectionable odor of this may be disguised with coumarin or with equal parts of powdered roasted coffee. The vulvar cleft should be kept filled with a layer of absorbent cotton held in place by means of a T-bandage. The bichlorid douche should be repeated about twice a day and the parts dried, dusted, and dressed as before. After the sloughs have separated and the granulations have become healthy, the iodoform should be discontinued and a powder consisting of equal parts of acetanilid, boric acid, and calomel should be used.

Exuberant granulations should be touched with silver, either a strong solution, gr. xxx-fʒj, or the solid stick. In serpiginous and phagedenic chancroids it may be necessary because of inflammation and the associated pain to use hot compresses of bichlorid solution 1:5000, or of lead water and laudanum. When the granulations have become healthy in these extensive cases a stimulating lotion such as the following is indicated:

R. Balsami Peruviani.....fʒij
Aq. destillatæ.....q. s. ad. fʒij
M.

The general condition of patients suffering with chancroids must receive careful attention. Iron, quinin, and strychnin are sometimes indicated. In the colored race especially, cod-liver oil and whisky, a half to one ounce of each, three times daily is of service.

Bubo is a not infrequent result of chancroids. Usually it is unilateral. When seen early the patient should be confined to bed, if possible, and an ointment applied to the affected gland composed of equal parts of ung. hydrarg., ung. bellad.,

ung. iodi., and ichthyol, spread on a piece of lint. Waxed paper should be placed over this and the whole held in place by an ascending spica bandage of the groin, applied so that firm, equable pressure is exerted upon the inflamed glands.

If suppuration is imminent, an early complete extirpation of the glands without rupture is the preferable treatment. If this is impossible, after opening the abscess all unhealthy tissue should be cureted or cut away and the cavity should be cauterized with pure carbolic acid and packed with iodoform gauze.

SKIN LESIONS OF THE VULVA.

Etiology and Symptoms.—Dermatitis of various forms may be found affecting the skin of the vulva. Eczema, herpes, and prurigo may occur here as elsewhere on the body. They produce symptoms which are clinically classed with vulvitis or with pruritis.

Treatment.—The treatment of vulvar skin lesions is the same as for similar lesions on other parts of the body, coupled with measures (see Pruritus, page 256) which protect the vulva from the effects of an irritating discharge, secure perfect cleanliness, and keep apposed surfaces apart (see Vulvitis, page 248).

PRURITUS VULVÆ.

Etiology and Pathology.—Itching of the vulva, or pruritus vulvæ, is a symptom of many local and general lesions, which produce irritation of the cutaneous nerves. It exists also as a pure neurosis. In some of the latter cases it is likely that at first the affection depends upon a well-defined lesion, the neurosis gradually becoming engrafted upon and replacing the local lesion. Sânger's¹ classification of the causes of pruritus vulvæ is as follows:

A. *Endogenous.*

(1) Hematogenous.—Icterus, nephritis, diabetes mellitus—from the products circulating in the blood,—bile, uric acid, urea, sugar—all of which may irritate the nerve-endings and produce itching. In the same way morphin, alcohol, iodin, and other drugs may produce pruritus.

(2) Congestive.—Venous stasis of the hemorrhoidal veins and the pampiniform vessels: in cases of heart weakness, pregnancy, retroposition of the uterus, and uterine tumors.

(3) Hematogenous skin diseases.—Erythema, urticaria, herpes, eczema.

B. *Exogenous causes.*

(1) Chemical action of secretions.

(a) Hyperidrosis, seborrhea.

(b) Continuous wetting with normal or pathologic (diabetic), intensely acid (uric), purulent, or alkaline (ammonia) urine.

¹Sânger M.: "Zur Aetiologie und operativen Behandlung der Vulvitis Pruriginosa," Centralbl. f. Gynäk., 1894, S. 154.

- (c) Pathologic discharge from vagina and uterus (acute and chronic gonorrhea, putrefying blood, catarrh of the cervix, cervical polyp, carcinoma and other new-growths).
- (d) Catarrhal and purulent secretion from the rectum, which first produces pruritus ani and then leads to pruritus vulvæ. This secretion is intensely irritant, and, especially in cases of adiposis and uncleanness, leads to the worst form of pruritus.

(2) Parasites.

- (a) Animal (pediculi, oxyuris vermicularis).
- (b) Vegetable (leptothrix, leptomitosis, oidium albicans, micrococcus ureæ; occasionally also the gonococcus, smegma bacillus, putrefactive organisms, the different skin parasites, streptococcus and staphylococcus).

(3) Mechanical.

- (a) Primary—masturbation; too frequent cleansing, especially with sponges.
- (b) Secondary—rubbing and scratching produced through itching.

(4) Thermal.—Under this head belong pruritus estivus, pruritus hemalis, and the increase of itching produced by a warm bath. In mild cases, and especially if there is a local lesion, pruritus is commonly referred to as a symptom of the disorder.

Pruritus vulvæ, as the term is used, implies either exaggerated itching in combination with a local lesion which has originated it, or itching the result of a general disorder or of a neurosis, or of a combination of these.

Symptoms.—The symptoms are always worse at night and under the influence of warmth and exercise. The congestion of menstruation and of pregnancy increases the severity of the symptoms. In aggravated cases the patient is unable to keep from scratching the parts. This gives temporary relief only and increases the irritation, so that the symptom becomes progressively worse. The patient may be unable to sleep and unable to restrain herself from violently scratching or rubbing the vulva on all occasions. She becomes nervous, avoids the society of her friends, and seeks relief in anodynes and hypnotics. The itching may extend to the inner side of the thighs and to the anus. As a result of the constant scratching and rubbing of the parts there results a thickening of the corium¹ from connective-tissue hyperplasia which affects also the nerve-endings. The vulvar skin appears thick and leather-like and has an unnatural whiteness of color, broken here and there by excoriations caused by the patient's finger-nails. In the later stages of the disease, considerable subcutaneous atrophy of the vulvar tissues may occur.

Treatment of this condition necessarily must depend upon the underlying cause in the particular case and upon the local lesions present. The general

¹ Webster, J. C.: "The Nerve Endings in the Labia Minora and Clitoris, with Special Reference to the Pathology of Pruritus Vulvæ," *Edinburgh Med. Jour.*, July, 1891, vol. xxxvii, Part I, p. 35.

treatment of icterus, nephritis, diabetes mellitus, heart disease, and pregnancy need not be discussed here. For pediculi we can recommend highly a 1:500 watery solution of mercuric bichlorid with equal parts of alcohol and ether. When the vulva is bathed with an irritating discharge from the vagina the patient should take a douche of bichlorid solution, 1:4000, several times a day, or the vulva and the vagina should be thoroughly cleansed by douching with a solution of bicarbonate and biborate of soda (of each a half ounce to a gallon of warm water), and a lamb's wool and cotton tampon should be placed in the vagina. The repetition of this treatment as often as indicated will effectually prevent the irritating discharge from coming in contact with the vulvar surface. When the urine is highly concentrated, potassium acetate and potassium citrate should be exhibited in large doses with plenty of water. In the presence of cystitis, benzoic acid (gr. x) and urotropin (gr. x), given alternately every three hours with a full glass of water, are efficacious. When the urine is irritating because of diabetes mellitus, icterus, or when there is actual nephritis, the treatment will have to be varied accordingly. The diet will require suitable regulation in the diseases last mentioned. When the irritating quality of the urine depends entirely upon concentration, a diet largely composed of skimmed milk should be selected. Alcohol, spices, and acids should be avoided. Rectal discharge should be controlled by frequent irrigation of the rectum with normal saline solution, followed by the introduction of f3ij of a 25 per cent. solution of argyrol or of a 2 to 5 per cent. solution of silver nitrate. Proctoscopic examination should be made to definitely determine the nature and the exact location of the disease. If it lies far above the anus, intestinal antiseptics by the mouth, coupled with high irrigation of the colon, must be used. Long-continued instillations of silver nitrate solution should be avoided lest they result in the production of argyria.

Skin lesions of the nature of actual primary cutaneous disease should be treated as they are elsewhere on the surface of the body.

The cases of pruritus which are most difficult to handle are those in which the condition cannot be ascribed to any demonstrable lesion. Under such circumstances the disease must be looked upon as a neurosis, and nerve sedatives and general tonic and hygienic measures are indicated.

For the relief of itching, alcohol and ether, menthol, or Goulard's extract may be of service. An ointment of ac. carbolic and menthol, of each gr. v-x to the ounce, is often beneficial. W. B. Small has had the best results with a 50 per cent. ointment of ol. terebinthinæ in petroleum jelly. Ung. belladonnæ (U. S. P.) or a 10 to 15 per cent. chloral ointment sometimes does good. Nothing is better for the itching of dermatitis than black wash and bismuth. Narcotics should be avoided. The most scrupulous cleanliness is to be observed and irritated surfaces are to be kept apart by the interplacement of cotton. The application of a strong solution of the nitrate of silver (gr. lx-f3j) or of pure carbolic acid is indicated in severe cases and will give at least temporary relief.

The infiltration of the tissues, after the plan of infiltration anesthesia, may be tried.

If none of these measures avail then the case should be operated upon. Surgical measures include excision of the itching skin, followed by a plastic repair, or excision of a portion of each of the following nerves: the dorsal nerve of the clitoris; the ilio-inguinal and the genito-crural nerves; the inferior pudendal, and the perineal branches of the pudic (see page 329).

VAGINITIS.

Etiology and Pathology.—The vagina is lined with stratified squamous epithelium which forms a good protection against an invasion of the submucosa by bacteria. This epithelial covering resembles that of the inner part of the vulva (inner surface of the labia minora, vestibule, hymen). It differs from the epithelial covering of the vestibule and inner surface of the labia minora in that it possesses no glands. Although occasionally glands have been found in the vagina, as a rule they are not present. The so-called vaginal secretion is therefore not largely of vaginal origin. It consists of transuded blood-serum mixed with the excretions of the uterus. It covers the entire vaginal wall to a moderate extent and collects in the vaginal vault in a somewhat greater amount. It is a whitish, creamy fluid which at times has a crumb-like appearance.

Microscopically one finds in the vaginal secretion desquamated epithelium, leukocytes, and microorganisms. The reaction of the vaginal secretion is acid. This is due to the bacillus of Döderlein, which produces lactic acid. There are other organisms commonly found in the vagina. The acidity of the vaginal secretion, and the antagonism between the normal vaginal bacilli and pathogenic organisms which chance to gain an entrance, are factors in the protection which the vaginal secretion affords. An inflammation of the vagina usually depends upon the frequently repeated introduction of organisms combined with a mechanical irritation or injury, or upon some general condition which lowers the normal resistance of the vaginal epithelium. In the young, where the horny layer of the epithelium is not well developed, and in the old, where the epithelial layer atrophies, there is not so much protection and vaginitis is more readily produced. The atrophy associated with an artificial menopause may predispose to vaginitis. Most cases of vaginitis are secondary to lesions of the uterus or tubes and result from the more or less constant accumulation within the vagina of irritating uterine discharges. Predisposing causes of vaginitis are the venous stasis and hyperemia incident to pregnancy, small abrasions of the mucosa, and the desquamation and irritation produced by foreign bodies. The exciting causes are largely the same as those which have been mentioned under vulvitis, such as irritating discharges from the cervix or from a vesicovaginal fistula, uncleanness, various fungi and exanthematous diseases, streptococcus or Klebs-Loeffler bacillus, and infection occurring in parturient women. Dysenteric discharges have been observed as a cause. The application of caustic solutions to the vagina is capable of producing vaginitis of a severe grade.

The gonococcus is perhaps the most frequent cause. Primary gonorrheal vaginitis, except in children, is rare. In the child gonorrheal vulvovaginitis readily occurs and forms a very infectious and intractable disease.

Clinically, vaginitis is usually chronic. Acute forms are found in streptococcus and diphtheritic infections, in the exanthematous diseases, and as the result of traumatism. Except in children, acute gonorrheal vaginitis is not common.

Macroscopically, vaginitis may be divided into the granular, the ulcerative, and the emphysematous forms. Vaginitis is generally characterized by increased vaginal secretion and by a swelling and reddening of the vaginal walls. The vaginal secretion is either milky, whitish, and thinner than normal, or it takes a yellowish-green color and becomes of a purulent consistency. The acidity is, as a rule, considerably diminished; often it is neutral, and not infrequently it is alkaline. Microscopically the vaginal secretion is found to contain an increase in the number of leukocytes and in the number of foreign microorganisms with a decrease in the number of normal vaginal bacilli. The diffuse form of vaginitis is usually found in an acute stage in younger individuals. In chronic vaginitis, and especially in all but very young persons, the vaginal mucosa has a granular appearance. This is caused by a localization of the inflammation to groups of papillæ in the subepithelial tissues. In older persons this same granular appearance may be produced by subepithelial hemorrhages. The epithelium over these localized collections of round-cell infiltration may desquamate, exposing the subepithelial connective tissue and forming small eroded areas. In the senile form denuded spots, if they happen to come into apposition, may adhere and produce more or less contraction of the vaginal canal. In gonorrheal vaginitis eroded spots are often found in the vaginal vault.

The actual ulcerative form of vaginitis—in which the destruction involves the subepithelial tissue and results in a cicatrix—is produced by a streptococcus or by a diphtheritic infection, by the use of caustics and by the pressure of pessaries. Ulcers may also occur from decubitus in marked cases of prolapsus uteri with inversion of the vaginal walls.

Mycotic vaginitis is a form caused by the action of certain fungi. The fungus which produces this affection most frequently is the *oidium albicans*. Smith and Radkey¹ report such a case. The woman had been pregnant about eight weeks. A previously existing leukorrhea became profuse and caused intense vulvar itching and burning. Later the vaginal discharge was thick, viscid, somewhat grumous, and of a dirty brownish hue, the color apparently being due to an admixture with blood. The walls of the vagina were covered with large numbers of grayish-brown, slightly elevated masses, which were easily detachable. Beneath them there was desquamation and swelling of the mucosa. Examination of the grayish-brown masses showed them to be made up of epithelial cells overlaid by mycelial threads and colonies of *oidium albicans*. Their dark color in contrast to the usual

¹ Smith, Allen J., and Radkey, O. H.: "Notes upon a Case of *Mycosis Vaginæ*," *Med. News*, 1903, June 27, p. 1204.

light color of thrush patches was attributed by the author to the presence of blood-corpuscles; otherwise the local appearance would have resembled ordinary oral thrush. In such cases as this, the intervening mucous membrane is either normal or it is swollen and red; beneath the mycotic patches the mucosa is eroded and swollen. Pregnant women are most often affected. Smith and Radkey (*loc. cit.*) mention the physiologic glycosuria of pregnancy and Friedreich's assertion that a retention about the parts of even a small amount of diabetic sugar from the urine of pregnant women will favor the growth of the thrush organism.

Emphysematous vaginitis (colpitis emphysematosa, colpohyperplasia cystica) is a rare form of vaginitis occurring chiefly in pregnant women. In this disease there develop in the subepithelial connective tissue multiple vesicles which are filled with gas. The condition is probably due to a particular form of organism. Macroscopically, the vaginal walls are swollen and show numerous elevations of various sizes, usually smaller than a pea. They appear as vesicles and at their summits show a bluish-black color. Upon pressure with the finger these give way and disappear without rupturing externally. If the vesicles are punctured gas escapes.

The symptoms of this affection are not very pronounced. There is slight leukorrhea and the vaginal walls are tender. The prognosis is good and the disease usually disappears several months after labor. The prognosis in non-pregnant women is also good, as the disease yields readily to treatment.

Symptoms.—In acute vaginitis there is a burning pain which is referred to the perineum and the vulva. There is a profuse leukorrheal discharge which varies in appearance according to the variety of the infection. The patient complains of backache and of painful defecation and urination. Usually vulvitis accompanies the vaginal inflammation. There is not much general reaction in the gonorrheal form. Even in the infant the temperature rarely was above 101°, as observed by Holt¹ in a large series of cases. In the streptococcus and diphtheritic forms the constitutional symptoms are grave.

In chronic vaginitis the symptoms are combined with those of a chronic vulvitis with which it is usually accompanied. There is a leukorrheal discharge which is more or less troublesome. Intense itching and burning are sometimes present in the vagina (pruritus vulvæ). There is more or less pain on walking or in sitting upright. The patient will sometimes complain of a sensation as if there were a foreign body in the vagina.

Treatment.—Rest in bed, saline laxatives, and cleansing vaginal douches of normal salt solution or of sodium bicarbonate and sodium baborate, of each a half ounce to a gallon of water, are indicated. Later, douches of a weak solution of bichlorid of mercury, 1 : 10,000, may be substituted. Opium and belladonna suppositories should be given to relieve pain, and general supportive measures taken to improve the general condition. The discharge should be caught upon

¹ Holt, L. Emmet: "Gonococcus Infections in Children," New York Med. Jour. and Philada. Med. Jour., March, 1905, vol. lxxxi, Nos. 11 and 12, pp. 521, 588.

pads of absorbent cotton placed at the vulvar outlet. These pads should be burned when soiled. The greatest precaution should be observed lest the infectious pus be transferred to the patient's eyes. After the more acute symptoms subside, tampons soaked in argyrol solution, 10 to 25 per cent., and later in nitrate of silver solution, 20 to 40 grains to the ounce, are of marked curative value.

In the treatment of vaginitis in children, complete isolation is advisable if there are other children in the family or institution. The child should have its own particular nursing bottles, napkins, etc. Tub-bathing should not be employed. Instead of sponges, absorbent cotton should be used for bathing purposes, and after using it should be destroyed. In other words, the case requires isolation as strict as that commonly observed in acute infectious diseases.

In the *chronic form of vaginitis* a number of local applications are of service; the general plan of treatment is about the same as that given for chronic vulvitis. Aside from cleansing douches, astringent solutions of sulphate of zinc and powdered burnt alum, of each a half dram to a quart of water, or a 1:4000 solution of potassium permanganate, may be used. The vaginal walls should be exposed by means of a Sims speculum introduced in the Sims or in the knee-chest position, and direct application should be made of the remedies advised for the treatment of chronic vulvitis. Tampons soaked in some of the following solutions are also useful: argyrol 25 per cent., ichthyol and lanolin 25 per cent., and silver nitrate 4 to 8 per cent. If the vagina is very tender and sensitive, ointments are preferable, such as equal parts of unguentum hydrargyri, unguentum belladonnæ, ichthyol, and lanolin. Carbolized vaselin (5 per cent.) or boric acid ointment (10 per cent.) may be used.

The cure of a chronic vaginitis cannot be expected until the causative factor is eradicated. When there is a tendency toward the formation of adhesions between apposed surfaces, especially in the senile form of vaginitis, the parts should be kept separated by means of tampons.

AFFECTIONS OF THE CERVIX.

For a discussion of the etiology, pathology, and symptoms of cervical affections see also the chapters on Bacteriology, Pathology, Curetage, and Amputation of the Cervix, also the section on Gonorrhea.

Local Treatment.—The cervix from its position is easily reached and can be readily treated. While many of the more serious affections of the cervix can be relieved by operation alone, some conditions can be cured or at least very much benefited by local applications. Furthermore, it is often advantageous to use local treatment for a time, preceding the operations of trachelorrhaphy and of amputation of the cervix, in order to put the parts in a healthier condition.

It should be urged most emphatically that any lesion of the cervix which suggests a malignant growth should not be exposed under any circumstances to local treatment.

The case should be immediately turned over to a surgeon, or tissue should be excised from the suspected part and submitted to an experienced pathologist.

The local means employed for the treatment of minor cervical affections include the application of escharotics and disinfecting solutions for the purpose of destroying infection; the introduction of tampons soaked in combinations of glycerin for the purpose of depleting the cervix or for the more continuous application of antiseptics; and the puncture and evacuation of Nabothian cysts.

Chronic Gonorrhea of the Cervix.—When gonorrhea of the cervix is acute, no local treatment save the vaginal douche is advisable. When, however, cervical gonorrhea is evidenced chiefly by an intractable discharge, the measures hereinafter described may be employed. The cervical secretion, which is thick and tenacious, offers an obstacle to the application of solutions to the cervical canal. In all cases where applications are to be made the cervical mucus should be first thoroughly cleansed away by means of small pledgets of cotton which have been soaked in an alkaline solution (sod. bicarb., sod. biborate, each ʒj; water, ʒvj). After removing the thick tenacious mucus a solution of formaldehyd (37 to 40 per cent.), carbolic acid (pure), or nitrate of silver, ʒj–fʒj, may be applied. The tip of an ordinary aluminium applicator should be wrapped with cotton and, after immersing it in the solution, it should be introduced as far as the internal os and pressed in every direction against the cervical mucosa. Care should be taken that the applicator does not go beyond the internal os. When these strong solutions are used the vagina should be protected by adopting the measures described on page 267, and the instructions to the patient should be the same as those given after an intrauterine application of the same solutions. Cervical leukorrhea is extremely intractable in many cases, and the physician will be obliged, not infrequently, after his efforts have failed to advise amputation of the cervix.

Laceration of the Cervix with Eversion of the Cervical Lips and Hypersecretion of the Cervical Glands.—Usually a case of this sort requires operation. If this is refused or if for any reason it is inexpedient, local treatment may relieve the symptoms. Churchill's tincture of iodine, ichthyol (pure), silver nitrate, gr. xx–fʒj, and lactic acid (pure) may be applied to the cervix in the same way as has been described on page 261. Such applications should be followed by a tampon of ung. ac. boracici, 10 per cent. The stronger applications should be made once in ten days. The weaker ones may be used two or three times a week. Instead of any direct application to the cervical canal, ichthyol and glycerin, 25 per cent., or argyrol and glycerin, 25 per cent., may be used in tampons, which are placed close to the cervix, after thoroughly cleansing it of this cervical mucus. Daily douches of normal saline solution taken in the manner prescribed on page 287 should be used in conjunction with these measures.

A form of cauterization of the cervix adapted to office practice has recently been suggested by Hunner.¹ By this method the cervical glands, which are the

¹Hunner, Guy L.: "The Treatment of Leucorrhea with the Actual Cautery," Jour. of the Amer. Med. Assoc., vol. xlv, No. 3, Jan. 29, 1906, p. 191.

source of cervical leukorrhea, are destroyed. It may be applied in office practice without giving an anesthetic. With the patient in the dorsal or lithotomy position, a broad-bladed Sims speculum is introduced into the vagina, the anterior lip of the cervix is firmly grasped with a tenaculum forceps, and the cervix is drawn as near the vulvar orifice as possible. The nurse or the assistant stands by with the cautery already heated. On transferring the cautery to the operator, the nurse continues to work the cautery bulb with one hand while she holds the Sims speculum with the other. The operator retains the tenaculum in one hand and manages the cautery blade with the other. Radial strokes should be made with the cautery blade, from the cervical canal into the cervical tissue, removing the cautery from the vagina after each stroke, as the patient feels the radiated heat on the vaginal walls. The patient is warned that she will feel the heat but that she must not move, as there will be no actual pain. An exception to this rule is found in those suffering from a painful cervical scar. This condition is rare, and when present it is advisable to use preliminary anesthesia by applying for ten minutes a pledget of cotton soaked in a 20 per cent. solution of cocain.

The number and the depth of the radial strokes depend largely upon the condition of the cervix, but in general five or six strokes are made at each treatment; the depth of the burn is from 2 to 5 mm., or, roughly, from $\frac{1}{8}$ to $\frac{3}{16}$ of an inch. The length of the stroke naturally varies with the condition present, but in general it should extend over the entire area of the hypertrophied cervical mucosa. The treatment is given once in three weeks. The vulva is protected with a sterile gauze dressing and the patient is warned that the leukorrheal discharge may be more profuse than ever during the first week; and that there may be slight bleeding. She is instructed to go to bed and remain there if the hemorrhage is at all profuse. Hemorrhage has not been known to occur on the day of the treatment, but there is often a little after the third or the fourth day, when the necrosis of tissue is at its height; and this may be sharp enough to alarm the patient. A daily douche is recommended in the interval between the treatments. Three treatments have produced such a beneficial effect in a marked case of leukorrhea that the patient considered herself cured, and did not come for further treatment. On an average ten treatments will be required.

Hypertrophy of the Cervix and Nabothian Cysts.—Nabothian cysts should be punctured with a spear-pointed knife or an ordinary bistoury, and the cyst contents should be expressed. Even though there are no cysts present, multiple punctures of the cervix or the extraction of blood by means of an artificial leech should be practised. These measures should be done with antiseptic precautions and should be followed by the application of a tampon soaked in the glycerite of boroglycerin. Ichthyol and glycerin, 25 per cent., or argyrol and glycerin, 25 per cent., may be used instead. Daily hot saline douches should also be prescribed.

General Treatment in Cervical Diseases.—During the local treatment of an inflamed or a hypertrophied cervix it is important to give the general condition adequate attention and to take care that the cervix is not freshly infected.

The general measures to be employed are the same as those recommended for chronic endometritis, on page 268. If the discharge from the cervix has originated in cervical gonorrhea, attention should be paid to the husband, and intercourse without prophylactic measures against reinfection should be forbidden until both husband and wife are cured.

ENDOMETRITIS.

Classification and Varieties.—Endometritis, or inflammation of the lining membrane of the body of the uterus, has been variously classified. The classification depends upon whether it is held that endometritis is due only to a bacterial infection of the mucous membrane, or whether other causes of inflammation are admitted. If bacterial infection alone is considered to be the cause of an inflammation, then chronic endometritis is less frequent than is usually supposed and acute cases are confined to gonorrhea and to infection following intrauterine manipulations and the puerperium. If, however, other causes of inflammation are accepted, various hyperplasias and atrophies of the endometrium are properly considered a result of chronic inflammation, and as a consequence the disease is recognized as being not at all uncommon.

The classification of endometritis which we adopt is: (1) acute and (2) chronic. The acute form of endometritis is produced by gonorrhea, infection following abortion or labor, and infection of the uterine cavity produced by instrumentation. In this form the inflammatory condition involves the endometrium as a whole. The chronic varieties of endometritis may affect the endometrium as a whole or they may affect chiefly the glands or the stroma, so that we may speak of glandular endometritis and of interstitial endometritis. The importance of this classification is principally from a morphologic standpoint. Clinically, acute endometritis only deserves individual attention, as the chronic forms of endometritis almost invariably occur in connection with, and are produced by, other lesions; so that the treatment of the endometritis in these cases is the same as, or must be combined with, the treatment of the complicating disease.

ACUTE ENDOMETRITIS.

In discussing acute endometritis it is necessary to differentiate between the gonorrheal and the septic forms.

Gonorrheal Endometritis.—*Symptoms.*—Gonorrheal endometritis usually begins either during the menstrual period or just after it. In some cases a cessation of the menstrual flow marks the passage of the infection to the endometrial cavity. The symptoms are general and local.

The *general symptoms* are a rise of temperature, which rarely reaches 101° F., an increase of the pulse-rate to a maximum of about 110° F., some pain in the back and lower abdomen, vesical irritability and tenesmus, constipation, and headache.

Local Symptoms.—At the beginning of the attack there may be a diminution

in the amount of leukorrhea to which the individual is usually subject. Within a few days, however, there is an increase of the leukorrheal discharge, which assumes a purulent character and is sometimes streaked with blood. The uterus is slightly enlarged and tender; the os is patulous. The presence of the gonococcus offers positive evidence of the nature of the condition. In some cases, however, even though the gonococcus is the exciting cause it will not be discovered in the uterine discharge. Usually, in such cases, the organism will be found in Skene's tubules or in Bartholin's glands. Gonorrheal endometritis very often passes directly into gonorrheal salpingitis, and from the symptoms alone in a given case it is at times impossible to say when one ends and the other begins.

Treatment.—The treatment of acute gonorrheal endometritis is mainly expectant. The patient should be placed in bed, the bowels should be kept freely open with salines, and the diet should be restricted. Over the lower abdomen an ice-cap or a large poultice, or else a turpentine stupe, should be applied—which ever gives the most relief. After the more acute symptoms subside, copious hot douches of bichlorid of mercury solution, 1 : 10,000, as described on page 287, may be given twice daily. In the acute stage of gonococcal endometritis any intrauterine manipulation is absolutely contraindicated. The physician should endeavor to allay the inflammation by depleting the pelvic blood-vessels and keeping the external genitalia and the vagina free from the infectious discharge. The latter should be caught upon pads of absorbent cotton or gauze placed at the vulvar outlet and held in position by a T-bandage. These pads when soiled should be burned. The patient should be warned of the infectious nature of the pus and of the danger of contracting gonorrheal ophthalmia, unless antiseptic precautions are taken. Under this plan of treatment the pain, the temperature, and the acute symptoms of the attack will gradually subside in from three to four days.

As a rule, stimulating treatment is not required. If the patient is weak, strychnin may be exhibited and milk or broth may be given every two or three hours.

Septic Endometritis.—The *general symptoms* of septic endometritis depend to a considerable extent upon whether pregnancy exists at the time of or previous to the infection. When the uterus is succulent and hyperplastic, as it is in pregnancy, the result of an infection of the endometrium is more serious than if the organ is in the non-pregnant state. Puerperal septic endometritis is frequently the first stage of puerperal pelvic inflammatory disease. In some cases the infection will go no further than the endometrium, but this is the exception rather than the rule. Under any circumstances, the general symptoms are those of puerperal infection as described on page 290. If the infection remains localized in the endometrium, the symptoms will be less severe than when it extends to the myometrium, to the pelvic peritoneum, or to the pelvic cellular tissue.

When the endometrium of the non-pregnant uterus is infected from dirty instruments or foreign bodies introduced therein, the general reaction resembles the symptoms of instrumental or post-operative pelvic inflammatory disease (see p. 283). In this as well as in the puerperal form it is often difficult to determine when the

infectious process has spread beyond the limits of the endometrium. Without going into detail, it may be said that the symptoms of acute septic endometritis usually consist of a rise of the temperature and of the pulse, actual chills or chilly sensations, headache, pain and tenderness in the lower abdomen, abdominal distention, nausea, and constipation or diarrhea.

The *local symptoms* depend upon the nature of the infecting organisms and the presence within the uterus of material undergoing necrosis or putrefaction. Usually at first there is a diminution in the quantity of the lochial discharge; indeed, there may be a complete suppression of the lochia for several hours. This may be due to the acute inflammatory process which temporarily interferes with uterine excretion, or it may be due to a flexion of the cervix or to a foreign body (decidual or placental tissue) which obstructs the cervical canal. Later the lochial discharge becomes more profuse; it is putrid and has a foul odor when there are decomposing membranes, placenta, or decidua within the uterus. Otherwise the discharge is purulent, perhaps streaked with blood. In some of the most violent cases of septic endometritis there may be almost no local reaction. Usually the uterus is enlarged and tender and the os is patulous.

Treatment.—The *local treatment* of septic endometritis depends in part upon whether there is any decomposing placental or decidual tissue inside the uterus. When the lochial discharge has a foul odor, it may be presumed that such is the case; in any event, unless the practitioner is sure that the uterus does not contain putrefying material the cavity of the uterus should be explored under anesthesia, dilating the cervix if necessary. All putrefying material must be removed by means of the finger, followed by the use of the curetment forceps and the dull curet; the uterine cavity should also be thoroughly douched with bichlorid of mercury solution, 1 : 8000, followed by normal saline solution. Thereafter manipulations within the uterus should be restricted. The patient should be kept quiet in bed, cold or hot applications should be made to the lower abdomen, and hot vaginal douches, as described on page 287, should be used twice daily. The bowels should be kept freely open by the use of salines, and the general supportive measures used which are described fully on page 292, under the treatment of Puerperal Inflammatory Disease. When the temperature remains elevated after the initial cleansing of the endometrial cavity, intrauterine irrigations of bichlorid of mercury solution, 1 : 8000, or of formaldehyd solution, 1 : 4000, followed by normal salt solution, may be given daily for several days, using the Fritsch-Bozeman uterine catheter. As a rule, intrauterine irrigations should be used conservatively; they must be discontinued at once if pelvic cellulitis or pelvic peritonitis results from the spread of the infection.

CHRONIC ENDOMETRITIS.

Chronic endometritis may be the sequel of an acute process, or it may be gradually excited and maintained by laceration and eversion of the cervix; fibroid tumor of the uterus; malposition of the uterus; pelvic adhesions; tubal and ovarian

enlargements, chronic constipation, and chronic pelvic congestion. In other words, it is the result of constant irritation, either bacterial or mechanical in nature.

Symptoms.—In chronic endometritis the symptoms depend mainly upon the complicating or causative lesion. Leukorrhea is a symptom which is very often and very incorrectly attributed to endometritis alone. The discharge in cases of chronic endometritis very often comes partly from the cervix, which also is apt to be involved in connection with a chronic inflammation of the corporeal endometrium. A discharge from the interior of the uterus is usually thinner than a discharge from the cervix; a cervical discharge is of a viscid, ropy character; usually the two are mixed, and it is often quite impossible to say whether the principal source of discharge is the endometrium or the cervix. The other symptoms of chronic endometritis are dysmenorrhea, menorrhagia, metrorrhagia, backache, occipital headache, and other reflex symptoms.

Treatment.—The treatment of chronic endometritis should be directed toward the underlying lesion. Direct treatment of the endometrium is only rational when at the same time the more important complicating or underlying lesion is receiving attention. Thus, in a case of endometritis complicating retroversion of the uterus, it is futile to direct any measures toward the endometrium if none is taken to correct the position of the womb. This is even more true when chronic endometritis is complicated by pyosalpinx; in which case direct treatment of the endometrium is dangerous because it is liable to induce peritonitis. In regard to the local treatment of endometritis, the authors are seriously opposed on general principles to any intrauterine manipulation, unless the cervix is well dilated and a complete antiseptic technic is observed. Asepsis cannot be observed in office practice unless all of the precautions and preparations which are used in operations in private houses are carried into effect. Applications to the endometrium are painful, in a large proportion of cases they do no good, and in many cases they are capable of doing much harm. Their use is much less efficient, more painful, and more dangerous than curetage. Formerly it was a common practice to apply various escharotics, such as chlorid of zinc and carbolic acid, to the interior of the uterus. Emmet was most prominent in pointing out not only the small field of usefulness of the intrauterine applications, but also their dangers; and largely as a result of his teachings, combined with the experience of the profession, at the present time the practice has fallen into deserved disrepute. There are few exceptions to this rule. If the cervical canal is widely dilated, they are permissible when carried out under full antiseptic precautions. Applications are also justifiable in cases where dilatation and curetage have failed to cure a purulent or a hemorrhagic discharge from the uterus. The following solutions under these circumstances may be applied to the uterine cavity: 40 per cent. solution of formaldehyd; carbolic acid; and silver nitrate solution 3j-f3j. The use of these chemicals will be followed by the formation and the discharge of a slough composed of the endometrial tissue which has been destroyed.

The Technic of an Intrauterine Application.—With the patient in the dor-

sal position, a bivalve speculum is introduced; by widely separating its blades the cervix is exposed. The cervix and the vaginal vault are now thoroughly scrubbed with green soap and hot water, and this is followed with bichlorid solution, 1:5000. The vagina is then packed with cotton pledgets soaked in bichlorid solution, 1:5000, and these are left in position while the applicators are being prepared. These should be of aluminium or silver (Fig. 151). Before arming them they should be bent so as to correspond to the flexion of the uterus in the individual case. The end of each sound should be wrapped with sterile cotton (the practitioner's hands as well as the sounds must, of course, be sterile) for about three inches. The cotton must be applied evenly and in a thin layer, so that there is no difficulty in passing the armed instrument through the cervical canal. The cotton should project slightly beyond the tip of the instrument. At least three sounds should be prepared in this way. The bichlorid pledgets are now taken out of the vagina and the excess of moisture is removed. The vaginal vault is packed with cotton pledgets or smeared with an ointment for protection. The cervix is caught with a tenaculum and steadied while the applicator is immersed in the solution chosen for application, and introduced under full view directly into the cervical canal. The excess of fluid absorbed by the cotton on the applicator should be pressed out against the side of the vessel containing the solution. The shape of the endometrial cavity should be borne in mind and an effort made to reach every part of it. In doing this it will be necessary to use each of the three applicators which have been prepared. After the application the protecting cotton pledgets are removed from the vaginal vault and the vagina is thoroughly douched with normal salt solution. This is followed by a sterile boracic ointment tampon and a sterile perineal dressing of gauze and cotton. The tampon is removed on the following day. The patient should be directed to be quiet for a few days after the application; she should be warned that her leukorrheal discharge may be at first increased and that some hemorrhage may occur. The pain of the application usually lasts but a few hours. A daily douche of sterile normal salt solution is to be ordered, and sexual intercourse or any procedure which might possibly result in the introduction of microorganisms is to be avoided. When the cervical canal is patulous, intrauterine applications are most apt to do good and least apt to do harm; under these conditions it is possible to apply solutions efficiently and good drainage is insured. No intrauterine manipulation or application should be made, unless the existence of salpingitis or of pyosalpinx has been excluded, by a careful study of the history of the case, and by bimanual examination. Unless the practitioner has perfected himself in making diagnoses by bimanual palpation, he should refrain from making intrauterine manipulations. Twenty years ago, when the nature of pelvic inflammation was not understood and when the making of intrauterine applications was a routine practice, the occurrence of uterine colic and pelvic peritonitis after applications was a common experience.

For most cases of chronic endometritis, as said before, intrauterine applications are not advised. In uncomplicated cases or in conjunction with the proper meas-

ures for the underlying lesion in the complicated ones, certain means may be adopted which tend to deplete the endometrial circulation and restore the pelvic blood-vessels to their normal condition. The patient also can be made more comfortable by the use of measures which keep the vagina and the vulva in a clean and healthy condition. To these ends the use of a daily douche made from the following formula is advised:

R. Ac. borici..... ʒvj
 Ac. carbolici.
 P. alum. exsicc. āā ʒj
 Ol. gaulth..... fʒj
 Ol. menth. pip. ℥xxx
 M. et S.—Tablespoonful to a gallon of water, used as a douche.

Two or three times a week a tampon soaked in the glycerite of boroglycerin may be inserted into the vagina. The bowels should be kept open, preferably by the use of salines. Tonics such as the tincture of nux vomica, ℥xv before meals, with sod. bicarb., gr. x, should be exhibited. If the patient is anemic, Bland's pill or the bitter wine of iron may be given. Both of these preparations of iron are well borne. Fowler's solution or some other form of arsenic may be combined with the drugs mentioned. Any functional deficiency of the heart's action should be treated.

The practitioner must not forget that chronic endocervicitis is frequently mistaken for corporeal endometritis. Indeed the endometrium, as has been intimated before, is rather exceptionally the seat of a leukorrheal discharge, unless there is a complicating lesion such as a pus-tube or a retroposition of the uterus. In every case of leukorrhea an effort should be made to determine positively the source of the discharge. Cervical discharge is thick and tenacious. From the endometrium it is less thick and has more of a serous consistency. Discharge may be detected as being uterine in some cases where the os is patulous by thoroughly cleansing the cervical canal and then observing the flow of excretion from above.

METRITIS.

Etiology and Pathology.—Theilhaber and Meir¹ pointed out the fact that many cases of leukorrhea and of uterine hemorrhage, which are referred to the endometrium, are really caused by alterations in the myometrium. There is no doubt that following puerperal or other forms of infection the uterine muscle may remain more or less permanently thickened and congested.

The endometrium is affected secondarily. Usually the endometrial capillaries are in a state of chronic engorgement, which results in an increase of the menstrual diapedesis and of the glandular excretion. Glandular endometritis may result from the continued irritation.

Symptoms.—The symptoms of this condition resemble those of uncomplicated chronic endometritis.

¹ Theilhaber u. Meir: "Die Variationen im Bau des Mesometrium und deren Einfluss auf die Entstehung von Menorrhagien und von Fluor," Archiv. f. Gynäk., Bd. lxvi, H. 1, S. 1.

Diagnosis.—There is a slight symmetric enlargement of the uterus which depends upon a thickening of the myometrium and is independent of any intramural or intrauterine growth. The endometrium may appear entirely normal or it may be the seat of a complicating endometritis. Sometimes a positive diagnosis can only be made by exclusion and after curetage and digital exploration of the uterine interior.

Treatment.—The same treatment is applicable as has been recommended for chronic endometritis. The systematic use of glycerite of boroglycerin tampons, or of solutions of ichthyol in glycerin, will be of service. Hot douches given through a bulb syringe, as advocated by Emmet,¹ may be tried. Careful attention should be given to the restoration of the general health, and especially to any loss of tone in the circulatory system, by tonic and by hygienic measures.

SUBINVOLUTION OF THE UTERUS.

Etiology and Pathology.—When the uterus remains enlarged and congested, six weeks after labor, and does not show the normal retraction and contraction, the condition is spoken of as subinvolution. Subinvolution may occur after labor at full term, after premature labor, and after abortion. Subinvolution affects also the ligaments of the uterus, which are left softened, elongated, and relaxed. Subinvolution may also affect the vagina. There are many causes of subinvolution. The most frequent one is retroposition of the uterus. Another cause is the retention within the uterine cavity of portions of the fetal membranes or of the placenta, or of decidual tissue. Another frequent cause, which commonly produces, first, a retroposition, and then results in a subinvolution, is the practice of leaving the bed too soon after confinement. This is especially true after an abortion or a miscarriage, for, by many patients, these are regarded as occurrences of little moment. Laceration of the cervix is another common cause. Relaxation of the perineum may lead to subinvolution through infection or by causing a malposition of the uterus. Infection of the uterus is another frequent cause.

Symptoms and Diagnosis.—The symptoms of subinvolution are a persistence of the lochial discharge, backache, a feeling of weight in the pelvis, and bearing-down sensations. Upon examination, one of the causes already mentioned will be found. The uterine body is rather soft and boggy, the cervix is more or less patulous, and can be dilated with ease.

Treatment.—The treatment of subinvolution depends very largely upon the cause. The treatment of subinvolution of the uterus, combined with retroposition, is mainly that of the malposition. The general plan of treatment is, first, to reduce the size of the uterus by the use of hot vaginal douches, glycerite of boroglycerin tampons, partial rest in bed, and saline laxatives, and then to replace the organ and use a pessary. Cases of subinvolution complicated by retroposition are the

¹Emmet, Thomas Addis: "The Principles and Practice of Gynecology," Philada., 1884.

most favorable ones for treatment by means of a pessary. One-third of them can be cured in this way. Other causes of subinvolution must be looked for in each case and must be removed. Thus, the uterus must be thoroughly cleared of retained membranes or of placental tissue, and marked lacerations of the cervix and lacerations of the pelvic floor must be repaired. In order to stimulate the uterine muscle itself to contraction a pill of ergotin, grs. iiij, pulverized digitalis, gr. j, quinin sulphate, grs. ij, and strychnin sulphate, gr. $\frac{1}{30}$, should be given three times daily.

CHRONIC PELVIC CONGESTION. VARICOCELE OF THE BROAD LIGAMENT.

Etiology and Pathology.—Chronic engorgement of the pelvic veins is the result of a number of conditions which tend to retard the return of venous blood from the pelvis. A woman who leads a life of ease and luxury, and one who only exceptionally uses enough muscular exertion to cause the blood to circulate freely, may show this condition. A number of causes usually act in combination. Among them are a more or less constant sitting position, constipation, and excessive venery. The pelvic vessels may also be engorged from weakness of the heart or from cirrhosis of the liver. When the venous engorgement has persisted for some time a permanent dilatation of the veins of the broad ligament results, spoken of as varicocele.

Symptoms.—The symptoms of chronic pelvic congestion are leukorrhea, menorrhagia, a feeling of weight and discomfort in the pelvis, and sometimes actual bearing-down pains. The patient tires easily, suffers from backache, and is indisposed to exertion. All of the pain is lessened if the patient remains in the recumbent position. The bowels are usually constipated and move only after a laxative is taken.

Diagnosis.—The diagnosis will depend upon the symptoms outlined above, combined with the absence of any gross lesion and the evidences of pelvic engorgement. Thus, the mucous membrane of the vagina and cervix appears congested and has a bluish tint, sometimes resembling slightly the very earliest discoloration of pregnancy. The disappearance of symptoms as soon as the recumbent position is assumed is another diagnostic factor. The diagnosis must often be made by exclusion. Examination of the patient in the erect posture will in bad cases disclose enlargement and fullness of the bases of the broad ligaments (varicocele), which disappears when the patient lies flat upon her back.

Treatment.—The bowels must be kept open by the daily use of a saline laxative. If the cardiac action is weak, it should be stimulated by digitalis or by strophanthus. General massage will be valuable until the patient has recovered a certain amount of muscular strength, when she should be encouraged to exercise daily in the open air. The sitting posture, straining at stool, and excessive sexual excitation should be avoided. Tampons soaked in the glycerite of boroglycerin should be applied to the cervix and the vaginal vault every other day. Daily hot water douches should be taken, with the patient in the recumbent posture.

When given with the Davidson syringe, according to Emmet (*loc. cit.*), they will be especially valuable.

ANTEFLEXION AND ANTEVERSION OF THE UTERUS.

The long axis of the uterus is normally directed forward. The intra-abdominal pressure is thus expended upon the posterior surface of the uterine body, and flexes it forward upon the cervix; as a result the axis of the uterine body and the axis of the cervix form an obtuse angle. This condition is spoken of as anteflexion. When the fundus of the uterus is directed forward and the axis of the uterus is a straight line, or nearly so, the uterus is said to be anteverted. When the uterus is bodily pushed forward, the organ is said to be in anteposition.

Anteflexion and anteversion of the uterus exist in the normal individual, and it has been said that they can be considered as pathologic conditions only when they are so exaggerated that they give rise to symptoms. Schultze¹ objects strongly to such a definition of pathologic anteflexion and pathologic anteversion. According to him, pathologic anteversion is marked by rigidity of the uterine muscle and more or less obliteration of the normal angle of flexion. The body of the uterus lies well forward, resting upon the superior surface of the bladder, while the cervix has a more posterior position than usual, and the axis of the organ is nearly a straight line. Pathologic anteflexion, he says, is marked by the lessened mobility of the organ; the congenital form depending upon a shortness of the anterior vaginal wall and a puerile development of the cervix, while the acquired variety is due to cicatricial contraction in the posterior segment of one or of both broad ligaments. He speaks of the dysmenorrhea and sterility often taken as the distinguishing marks of pathologic anteflexion as the symptoms of an accompanying metritis and endometritis. The authors cannot agree wholly with Schultze; they regard acquired pathologic anteversion, as described by Schultze, as extremely rare. They are convinced, moreover, that pathologic anteflexion is frequently evidenced more by the symptoms than by any alteration in mobility or by any increase in flexibility.

Many cases are at once apparent on bimanual examination from the excessive flexion combined with shortness of the anterior vaginal wall and the imperfectly developed corpus or cervix, but there are a large number of cases of so-called pathologic anteflexion where the configuration of the uterus is apparently normal. No doubt many times dysmenorrhea and sterility are wrongly ascribed to anteflexion, but, until more is known concerning the relation between dysmenorrhea and the size and patulousness of the cervical canal, the diagnosis of pathologic anteflexion will be made, even though the angle between the cervix and the body of the uterus is no greater than it is in many entirely normal individuals.

Pathologic anteflexion of the uterus is usually congenital, although acquired

¹Schultze, B. S.: "The Pathology and Treatment of Displacements of the Uterus" (translated from the German), New York, 1888.

forms occur as the result of peritonitis, and, in rare instances, of cellulitis. Ante-position of the uterus is found in those cases where the uterus is bodily pushed forward. This displacement is produced by collections of fluid or tumors of any sort which occupy the pouch of Douglas.

Three varieties of pathologic ante-flexion have been described—cervical, corporeal, and combined. In the first the body of the uterus is in a normal position while the cervix is flexed acutely forward; in the corporeal form just the opposite of this exists; in the combined form both the body and the cervix are flexed forward.

The chief symptoms of ante-flexion are dysmenorrhea and sterility. The dysmenorrhea is supposed to be caused by a narrowness of the cervical canal, either from imperfect development or from constriction at the point of flexion. In many cases the symptoms present are due to associated conditions, such as endometritis, metritis, or to a neurosis. The sterility may be due to obstruction of the canal either at the external os or above it; to an associated endometritis, either cervical or corporeal.

The treatment of pathologic ante-flexion is closely associated with the treatment of dysmenorrhea. As there is often more or less doubt as to whether dysmenorrhea is due to an obstruction of the cervical canal or is purely a neuralgia depending on no recognizable lesion, it is wise to adopt general measures at first before resorting to operation. If these do no good then operation may be advised. The medical treatment of dysmenorrhea has been already described on page 237. If the painful menstruation actually depends upon an increased flexion of the cervix and resulting kink in the cervical canal, or is due to a "pinhole os" and stenosis, then operative measures are in order. Little could be accomplished by medical treatment alone in cases of pathologic ante-flexion evidenced by sterility. Under such circumstances operation only will correct the narrowing of the cervical canal. The operation of choice is dilatation of the cervical canal. When dilatation of the cervix is performed in cases of pathologic ante-flexion, the dilatation should be made slowly, and the operation should be done thoroughly. Other operations have been advised, such as amputation of the cervix when it is long and narrow, and the operation of Dudley. Neither of the authors has felt the necessity of the latter operation, if dilatation is well performed.

Pathologic anteversion, if it is ever encountered, should be treated by depleting measures, such as the application of glycerite of boroglycerin tampons, hot saline douches, followed by rest in a recumbent position, and the daily use of a laxative, to overcome the complicating metritis. The treatment of ante-position of the uterus is that of the lesion producing it, whether it be a tumor, inflammatory adnexal disease, or chronic pelvic peritonitis.

Acquired ante-flexion, due to the contraction and organization of lymph in Douglas' pouch, is merely a complication of the disease (usually salpingitis) causing the peritonitis. In such cases if the appendages do not require removal, the mobility of the uterus may be increased by the systematic use of vaginal tampons, to stretch and to promote the absorption of the adhesions.

LATEROFLEXION AND LATEROVERSION OF THE UTERUS.

Etiology and Pathology.—Lateroflexion and lateroversion of the uterus, in which the corpus uteri is drawn to one side of the pelvis, are found in connection with adhesions and cicatrices following pelvic exudates, or in connection with scar tissue following lacerations of the cervix which have extended into the parametrium.

Symptoms.—The symptoms of lateroversion of the uterus do not come from the misplacement of the organ itself but from the associated exudate, scar tissue, or adhesions. Consequently, the treatment of the lateral version is usually the treatment of the underlying cause. Massage or efforts at replacement should not be undertaken unless the preëxisting inflammatory lesions have undergone resolution. Should disease of the uterine appendages exist, this must first receive the treatment appropriate to the particular case.

Treatment.—The condition is not amenable to any local treatment further than the application of massage and a systematic tamponade of the vagina; both of these measures should be undertaken in an effort to restore the uterus to its normal position and its normal range of mobility.

RETROPOSITION OF THE UTERUS.

For a discussion of the etiology, pathology, symptoms, diagnosis, and operative treatment see Chapter XIII.

Non-operative Treatment.—Uncomplicated cases of retroposition only are suitable for treatment by means of a pessary. When the pelvic floor is relaxed or when there are adhesions which bind down the uterus or the adnexa, the use of a pessary is contraindicated. No good can be accomplished by the pessary under these conditions, and much harm may result from its use. If the uterus can be replaced bimanually, without the exertion of any force, it is an evidence that the organ is not adherent. If the first effort at replacement fails, unless gross evidence of pelvic inflammatory disease is found, it is not necessarily an indication of the existence of adhesions. This would be true if the patient were anesthetized when the attempt at replacement is made. The administration of an anesthetic in order to determine whether or not there are adhesions is often unadvisable because of the loss of time which is entailed and of the fear which patients have of it. Consequently if the first attempt at replacement fails, and yet no positive evidence of tubal or ovarian trouble is found, the patient may be put upon the preparatory treatment described below and the attempt may be repeated at a later date. There is no doubt but that this preparatory treatment will sometimes stretch or even break very light adhesions. From this the patient suffers no discomfort, as the process is slow and extends over several weeks. When the uterus is replaced under anesthesia, a pessary may be introduced at once if the organ is easily retained in its normal position. If considerable pressure is required to maintain the uterus in its proper place, the preparatory treatment outlined below should be employed before a pessary is introduced.

Replacement of the Uterus.—The non-adherent, retroverted, or retroflexed uterus can be replaced usually by the following method: The patient, being in the dorsal position, with the thighs flexed, with the clothing loosened, and with all waist-bands unfastened, should be instructed to relax the abdominal walls and to breathe regularly. The examiner introduces two fingers of the left hand within



FIG. 165.—THE CERVIX IS GRASPED WITH A DOUBLE TENACULUM.



FIG. 166.—THE CERVIX IS DRAWN DOWNWARD AND FORWARD, REDUCING THE ANGLE OF FLEXION.

the vagina up to and behind the cervix. The uterus as a whole is first elevated by the fingers pressing through the posterior vaginal wall, and then an effort is made to flex the corpus forward by pressure with the two fingers. If by this means the fundus cannot be grasped by the right hand manipulating through the hypogastrium, the index-finger of the left hand may be slipped in front of the

cervix to push the cervix backward while elevating the whole uterus. As a rule, the fundus is easily grasped by the right hand and brought into normal position by bimanual manipulation. Occasionally the fundus is incarcerated between or below the uterosacral ligaments and must be released by manipulation. More



FIG. 167.—THE FUNDUS, NOW WITHIN REACH OF THE FINGER INTRODUCED INTO THE RECTUM, IS PUSHED UPWARD AND FORWARD.

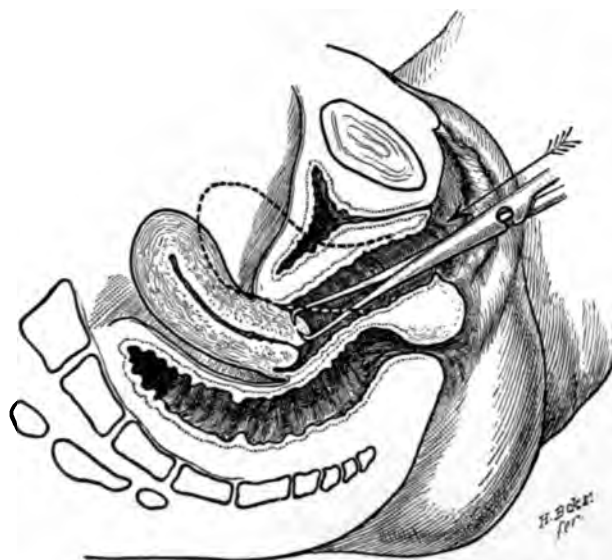


FIG. 168.—THE FINGER HAVING BEEN REMOVED FROM THE RECTUM THE CERVIX IS PUSHED DOWNWARD AND BACKWARD.

frequently the projection of the promontory of the sacrum interferes with the use of the right hand. In such cases the uterus must be pushed to one side by the intravaginal fingers before an effort is made to grasp the fundus. If this maneuver fails the following may be tried:

1. The cervix of the uterus is grasped with a tenaculum and drawn toward the vaginal outlet; this partly overcomes the angle of retroflexion. The forefinger, protected by a rubber cot, is introduced into the rectum and pressure upward is made upon the fundus, reducing the retroflexion or even producing a slight ante flexion (Figs. 165, 166, and 167).

2. With the forefinger in the rectum pushing the body of the uterus forward, the cervix is pushed backward into the hollow of the sacrum by means of the tenaculum (Figs. 167, 168).

3. The finger is now removed from the rectum, the rubber cot is removed, and the cervix is released from the tenaculum. The finger is now introduced into the vagina and the cervix is pushed backward while the abdominal hand tries to grasp the fundus uteri from behind and draw it forward (Figs. 169, 170).

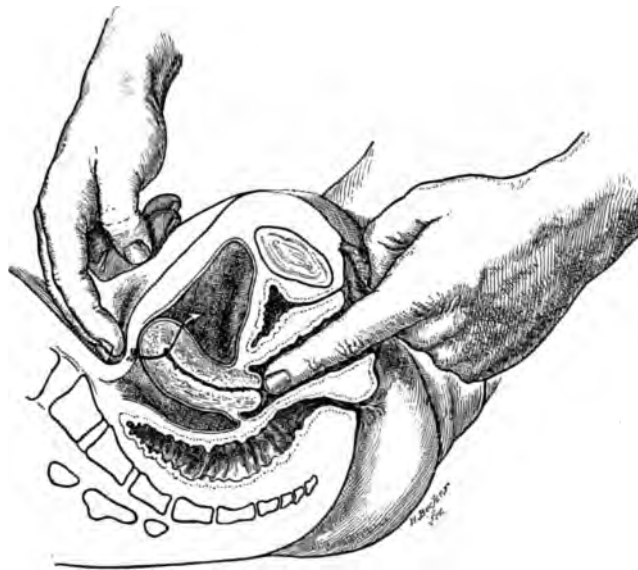


FIG. 169.—THE INTRAVAGINAL FINGER PUSHES THE CERVIX BACKWARD, WHILE THE ABDOMINAL HAND COAXES THE FUNDUS FORWARD.

These manipulations depend for their success largely upon the fact that the uterus is pivoted transversely, at about the position of the internal os, by its surrounding attachments to the vagina, parametrium, and bladder; so that whatever pushes the cervix back has a tendency to throw the fundus forward. The principle upon which the pessary is used in retroversion, and the rationale of the operation of shortening the uterosacral ligaments is based upon this fact.

Treatment Preparatory to the Use of a Pessary.—When attempts at replacement fail and yet no evidence of pelvic adhesions or of inflammatory trouble is present, the failure may be due to rigidity of the abdominal walls, to sensitiveness on the part of the patient, or to enlargement of the uterus. In the case of a non-adherent retroposition of a subinvolted uterus, the organ may be so enlarged

that it fits into the hollow of the sacrum and cannot be swung past the sacral promontory by the small amount of force which is permissible. Under such circumstances the patient should be treated three times a week by means of tampons which have been soaked in the glycerite of boroglycerin. The first few treatments may be carried out with the patient in the dorsal position, and several small tampons may be placed behind, beneath, and in front of the cervix. After this treatment has resulted in a diminution of the size of the uterus, and the patient's confidence is obtained, the treatment may be made in the knee-chest position or in Sims' position. The assumption of the latter has a tendency to throw the uterus forward and to balloon the posterior vaginal fornix. Two small tampons

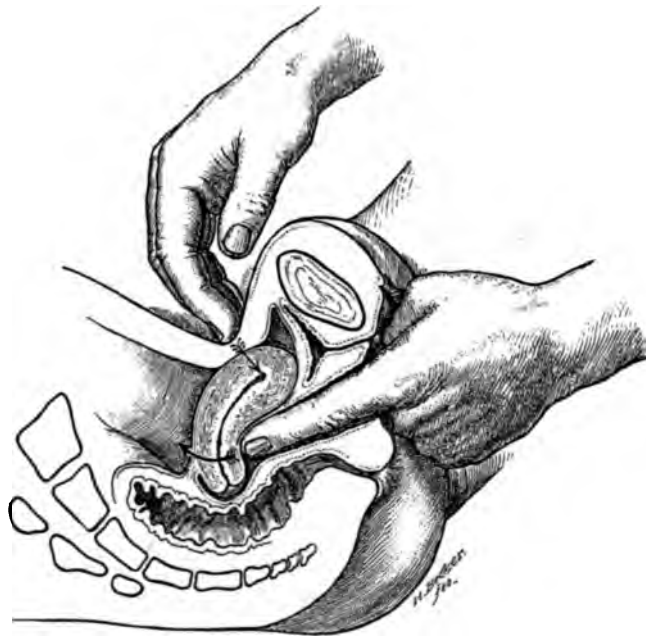


FIG. 170.—THE UTERUS HAS BEEN REPLACED IN ITS NORMAL POSITION.

are introduced behind the cervix which fill the vaginal vault and simulate the action of a pessary, *i. e.*, they have a tendency to pull the cervix backward by the tension they exert on the uterosacral ligaments; as the cervix is pulled backward the fundus is thrown forward. The small tampons are held in place by one or two large ones placed in front of the cervix (Fig. 171).

The number and the size of the tampons should be varied to suit the individual. As a rule, the smaller the posterior tampons, the more accurate is the pressure obtained. Each time the patient comes for treatment an effort should be made to push the uterus forward. This can be tried, without the use of a tenaculum, by pressing backward on the cervix with the vaginal hand, and endeavoring to lift forward the fundus by means of the abdominal hand. By such a plan, in a con-

siderable number of cases, the uterus can be gradually coaxed into its normal position.

If, after six weeks' trial, the uterus does not regain its normal position, the patient should be anesthetized and the question of adhesions definitely settled. When the ovary of one or both sides is prolapsed the case is distinctly unfavorable for the use of a pessary. However, in a few cases, after repeated tamponade of the posterior vaginal vault, the ovarian ligaments will regain their tone and hold the organs in a good position. After the uterus can be brought easily into a good position, the patient should be measured for a pessary.

The Fitting of a Pessary.—The patient should be in the dorsal position. A

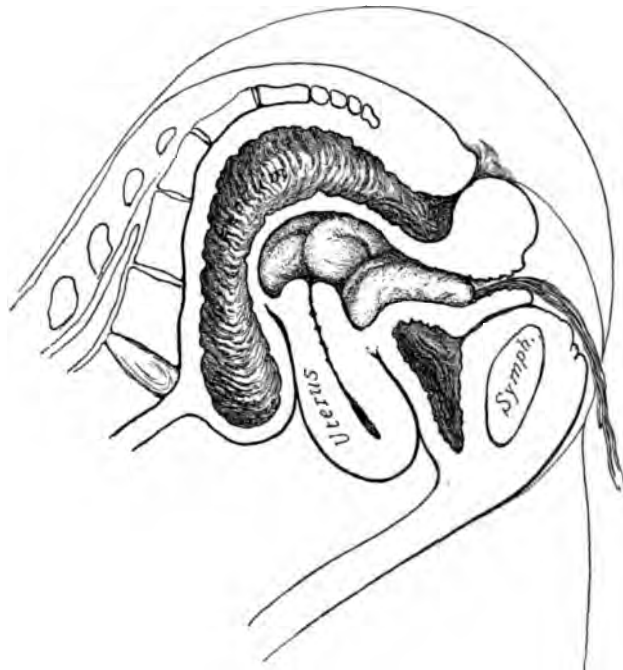


FIG. 171.—TAMPONS IN POSITION INTRODUCED IN KNEE-CHEST POSITION.

pair of dressing forceps is protected with cotton at the end and passed on the finger as a guide to the top of the posterior vaginal vault. On the shaft of the instrument a point one-half inch within the external urinary meatus is marked; the instrument is withdrawn and the distance between this point and the end of the instrument is measured; the pessary should be of this length. The forceps is reintroduced into the vagina as far as the cervix; by separating the handles, the blades of the instrument are made to touch the lateral vaginal walls on each side. The distance between the handles is noted and the instrument is closed and withdrawn. After restoring the separation of the handles to the degree observed, the distance between the tips of the forceps blades

should be measured; the greatest lateral diameter of the pessary should correspond to this measurement. These measurements may be more conveniently taken by means of a specially devised instrument known as the vaginometer (Fig. 172). If the pessary supplied by the dealer does not meet the required proportions exactly, it can be altered sufficiently to suit the needs of the case by softening the rubber in boiling water and then reshaping it into the form desired. Ordinarily a Smith-Hodge pessary is used. If the pelvic floor is at all relaxed a Hodge

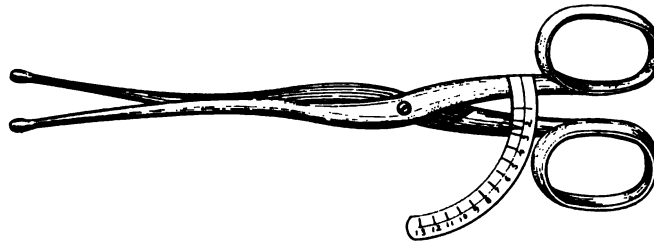


FIG. 172.—BAKER'S VAGINOMETER.



FIG. 173.—SMITH-HODGE PESSARY IN POSITION.

pessary, which has a wider lower bar, is more suitable. When the vaginal vault is low, an Emmet pessary should be selected. Each of these pessaries has a greater and a lesser curvature. The upper curvature is the greater and the upper bar in both is broader than the lower, although less so, relatively, in the Hodge pessary. In case the vagina is short and the vaginal vault is low, the greater curvature will need to be diminished. When the vaginal vault is high it may be necessary to increase the curvature.

With experience the physician will learn to select a suitable pessary by digital

examination, using two fingers. The length and the breadth of the vagina, the height of the vaginal vault (posterior fornix), and the condition of the perineum will be estimated so accurately that a suitable pessary can be selected.

Prognosis of Pessary Treatment.—The prognosis of pessary treatment in retroposition of the uterus depends upon the type of case in which it is used. The best results are obtained in puerperal cases in which the treatment is begun early and is systematically pushed to a successful conclusion. In non-puerperal cases in married women the pessary will cure a much smaller percentage of cases, but it will keep many women comfortable as long as it is used. In unmarried women pessary treatment for several reasons is usually objectionable. Even if it is tried the majority of patients will not be relieved; there is always danger, too, that local treatment of any sort will damage the nervous system and result in a mental state which ties the woman to a physician's office, and often leads to the development of a psychosis.

DESCENSUS UTERI.

For a discussion of the cause, etc., see Chapter VI, page 419.

Non-operative Treatment.—The treatment of descensus uteri—in other words, the treatment of the first stage of prolapsus uteri—is mainly that which has been described for uncomplicated retroposition of the uterus, descensus uteri being very often accompanied by retrodisplacement. Sometimes the uterus is low in the pelvis without any pronounced tendency to turn backward. In such a case it should be supported by means of tampons introduced several times a week with the patient in the Sims or in the knee-chest position. If there is pelvic congestion, or if the uterus is large and heavy, the tampons should be soaked in the glycerite of boroglycerin, and various depletory measures, as described on page 270, should be added. Even though there is no retroposition, the introduction of an Emmet pessary will be advisable in any case where the symptoms are marked. When descensus uteri is due to subinvolution it is readily curable; when it is due to a loss of tone of the ligaments of the uterus a cure depends upon an improvement of the general health, with the resulting improvement in the tone of the pelvic structures; when descensus uteri is due to laborious work or to tight lacing, the cure must depend upon securing a change in the habits of the patient.

PROLAPSE OF THE UTERUS.

For a discussion of the cause, pathology, symptoms, diagnosis, prognosis, and operative treatment see Chapter VI, page 419.

Non-operative Treatment.—Nothing can be done in a curative way for prolapsus by any form of local treatment; even in the sense of a palliative, local treatment is usually quite unsatisfactory. In preparing a patient with prolapsus uteri for operation there is very much to be done by local means. A prolapsed uterus may be tem-

porarily held in place by a vaginal tamponade of gauze or of cotton. The uterus is first replaced, the strip of gauze or cotton is then passed back of the cervix to the highest point in the vaginal vault, and packed continuously around the cervix and in front of it, completely filling the vaginal vault and exerting some pressure laterally in the vaginal fornices. Below this the vagina should be loosely packed. This tamponade forms a large spherical mass embracing the cervix and finds support upon the lateral walls of the pelvis and upon the pubic rami. Hard and soft rubber ring pessaries are useful in the palliative treatment of prolapsus. The uterus should be replaced and a pessary of such size introduced as will distend the vaginal fornices to the greatest extent short of producing discomfort. In such cases the pessary is supported by the vaginal walls and the rami of the pubes. This is necessarily a makeshift plan of treatment and it should never be employed unless an operation is contraindicated.

PELVIC INFLAMMATORY DISEASE.

Classification, Etiology, and Pathology.—Pelvic inflammatory disease is a term which may be used to denote the more serious lesions of an inflammatory type which involve the pelvic organs. Such lesions may be acute or chronic and may involve either singly or in combination the uterus and adnexa (metritis, salpingitis, ovaritis); the pelvic peritoneum (peritonitis); and the pelvic cellular tissue (cellulitis, lymphangitis, parametritis). As a rule, the uterine body (metritis) and the adnexa (salpingitis, ovaritis) are affected in combination with the peritoneum. The cellular tissue may be involved in conjunction with these structures, but at times it is affected alone, and then forms a distinct anatomic variety of inflammation (see page 296).

From an etiologic standpoint these conditions, as a rule, result from bacterial infection. Some of them may result from severe wounds, from contusion, from prolonged pressure, and from persistent mechanical irritation.

It is convenient to classify cases of acute pelvic inflammatory disease into post-operative, gonorrheal, and puerperal forms. An infection which occurs during operation or instrumental manipulation depends usually upon the streptococcus, the staphylococcus, or the bacillus coli communis. Post-operative pelvic inflammatory disease is often not the indication of a new infection but rather the result of the outbreak and the extension of an old one existing and perhaps unrecognized before operation. Such an infection is usually gonorrheal.

The gonococcus plays an important rôle in the pathology of pelvic inflammatory disease. Just what percentage of inflammatory cases are due to the gonococcus it is difficult to determine; the pus in old cases of pyosalpinx is very often sterile and no organisms can be recognized either from cover smears or from cultures. Miller¹ examined bacteriologically 43 cases of pyosalpinx, ovarian abscess, etc.,

¹ Miller, G. B. (quoted by H. A. Kelly): "Operative Gynecology," 1899, vol. ii, p. 211; New York.

which had been removed by laparotomy. Of these cases 33 were negative; in 7 the gonococcus was found; a mixed infection of the streptococcus and the staphylococcus occurred once; in 1 case the organism could not be diagnosed, and in 1 the culture was contaminated. Krönig¹ in 122 cases of suppurating salpingitis or pyosalpinx found 75 negative; the gonococcus was found in 28 cases; the tubercle bacillus in 8; the streptococcus in 3; and the staphylococcus in 1; in 1 case the bacillus coli communis, in 1 saprophytes, and in 1 an unknown organism was found. Mixed infection occurred in only three instances. Besides the organisms mentioned, the bacillus typhosus and the diplococcus pneumoniae, and some of the still rarer forms of microorganisms, have been found in non-puerperal pelvic inflammatory disease. The gonococcus is the infectious organism in the great majority of these cases, and for this reason we are justified in paying particular attention to gonorrheal pelvic inflammation.

In puerperal inflammatory disease the streptococcus plays the most important rôle. Williams² examined the uterine lochia in a series of 150 cases of his own in which the temperature rose to 101° F., or higher, during the first ten days of the puerperium. He found the streptococcus in 31; the bacillus coli communis in 11; the gonococcus in 7; the staphylococcus in 4; mixed infection in 14; unidentified aerobic bacteria in 4; unidentified anaerobic bacteria in 8; the bacillus of diphtheria in 1, and the bacillus of typhoid fever in 1; 25 of the cases were absolutely sterile; while in 45, although bacteria were found on the cover-slips, no growth occurred on any of the more usual culture-media. Notwithstanding the fact that the streptococcus is the most frequent organism to produce infection in the puerperium, the bacillus coli communis, the gonococcus, and the staphylococcus play a considerable part.

There is another variety of organism which must be considered in connection with puerperal pelvic inflammatory disease, and that is the saprophyte. The saprophytic organisms which develop in placental or decidual remains are anaerobic and do not grow on the usual culture-media. Many of them produce gas and cause a frothy, ill-smelling discharge, which is characteristic of putrefaction. The absorption of the products of these organisms produces a form of toxemia known as sapremia. Many of the cases which are diagnosed clinically as sapremia are actually instances of toxemia due to pyogenic organisms. For this reason Williams (*loc. cit.*) states that the diagnosis of sapremia is not justified unless an examination of the lochia has shown it to be free from any pyogenic germ.

The course of a given case of pelvic inflammatory disease depends upon three things, viz.: the type of the infection, the condition of the genital organs at the time of its occurrence, and the vital resistance of the woman. In other words, an infection due to gonorrhea pursues a course which is different from that of one due to the streptococcus; and either of these infections is more serious during pregnancy

¹ Menge, C., and Krönig, B.: "Bacteriologie des weiblichen Genitalkanals," Theil I, S. 264; Leipzig, 1897.

² Williams, J. Whitridge: "Obstetrics," New York, 1903.

or the puerperium than at any other time. For example, an infection with the streptococcus during an operation upon the uterovaginal canal does not give a clinical picture of the same severity as a like infection following labor, at full term or following abortion; and gonorrhea, when it extends to the adnexa, during the puerperium, advances with unusual rapidity. During pregnancy and the puerperal state the genitalia provide a field most favorable to the growth of bacteria and to the absorption of their toxic products; and the anatomic changes in the lymphatics and the blood-vessels favor the development of lymphangitis, phlebitis, and septicemia.

We may, therefore, discuss these diseases under three headings: viz., post-operative or instrumental, gonorrheal, and puerperal. They vary in their mode of onset, in their clinical course, in their prognosis, in their end results, and, to a less extent, in the treatment which each requires.

INSTRUMENTAL OR POST-OPERATIVE PELVIC INFLAMMATORY DISEASE.

Etiology and Pathology.—Pelvic inflammatory disease may follow intrauterine manipulation and operation on the uterovaginal canal. It results from the direct introduction of infectious organisms or from the spread of an infection already present. Infection may be directly introduced in the course of a plastic operation upon the vagina or the cervix, or during curetage. Such an accident is very rare in the hands of an operator who employs care in his technic. The use of soiled instruments in the course of an examination, or the passage of a sound into the uterus without the thorough scrubbing and disinfection of the vagina and the cervix which should always precede it, has been a fertile source of infection in the past. At the present day no competent and intelligent physician would commit such an error. Attempts to produce abortion by the unskilled or the uncleanly are very often followed by septic infection. If pregnancy has actually existed the infection resembles puerperal sepsis and should be classed as such. There are many instances, however, in which infection has occurred from the introduction of a foreign body into the uterus with the purpose of producing abortion, when the organ really has not been pregnant. Under such circumstances the result of an infection is less serious than if the uterus were pregnant. Symptoms of pelvic infection which follow an aseptic operation are usually the result of the extension of an inflammation which existed, but was not recognized, at the time of the operation. This may have been localized in the endometrium, in the tubes, or in the ovaries. While it is sometimes impossible to detect an inflammatory process of this sort, it should always be kept in mind, and every operation upon the uterus should be preceded by a careful pelvic examination; in cases of pyosalpinx, ovarian abscess, or pelvic peritonitis, acute or chronic, the manipulations must be practised with great gentleness, or the abdomen must be opened and the diseased condition corrected.

Symptoms.—The symptoms depend upon the nature of the infection. If it is gonorrheal and has resulted from an extension of the disease to the tubes or to the

pelvic peritoneum, the symptoms will be those of gonorrheal peritonitis (page 286). If the trouble results from the introduction of septic organisms during an operation, or during the passage of soiled instruments or of foreign bodies into the uterus, the symptoms will develop soon after the operation or instrumentation and will resemble those of puerperal infection (page 290). They are, as a rule, less severe because the opportunity for a rapid proliferation of the infecting microorganism and the absorption of its toxic products is not so great as it is in the puerperium.

Treatment.—If there is good reason to believe that the symptoms depend upon the extension of a gonorrheal infection to the pelvic peritoneum, the palliative and conservative measures described on page 287 are advisable. When the symptoms appear to have followed the introduction of microorganisms during an operation, the operative field should be exposed immediately and, as far as possible, it should be thoroughly disinfected. While in many cases this will be of no avail, it should always be done. All blood-clots and purulent material should be removed and the parts should be irrigated with an antiseptic solution. Alcohol (80 per cent.) penetrates the tissues further than almost any other suitable disinfectant, and should be used with this object. Aside from the disinfection of the operative field, an expectant policy should be adopted. The patient should be kept quiet in bed; hot vaginal douches and hot applications to the lower abdomen should be employed. The bowels should be kept freely open; a light nutritious diet should be given, and stimulants should be prescribed if the symptoms become dangerous, as in cases of puerperal infection. Infection following attempts to produce abortion (when the uterus is not pregnant), by the unskilled or the uncleanly, is a most dangerous form of instrumental or post-operative pelvic inflammatory disease. It is advisable in such cases to gently dilate the cervix and explore the uterine cavity. If the case is seen early and the uterus has been perforated an immediate laparotomy is indicated. Otherwise, except for the removal of any blood-clots or pyogenic material from the interior of the uterus, the treatment is purely expectant and supportive, as described on page 292.

GONORRHEAL PELVIC INFLAMMATORY DISEASE.

Etiology and Pathology.—Gonorrheal infection usually travels by continuity along the mucous membranes of the genital tract. Exceptions to this are noted in the rare instances of gonorrheal cellulitis, in gonorrheal arthritis, and in gonorrheal endocarditis. (See Gonorrhea, page 305.) The gonococcus, having been implanted in the tissues of the cervical canal, is afforded an opportunity to pass into the endometrial cavity by any circumstance which produces a dilatation of the internal os. This may occur at the menstrual period, after labor, or during some intrauterine manipulation. The endometrium once infected, the disease is very apt to extend to the Fallopian tube, and thence to the pelvic peritoneum. In the course of its passage through the tube, gonorrhea produces an inflammatory infiltration and swelling of the mucosa. In severe cases the tubal wall is similarly

involved. When gonorrheal pus escapes from the abdominal ostium, it irritates the pelvic peritoneum and sets up a violent inflammatory reaction around the fimbriated extremity. The tube, because of its increased weight, sinks lower in the pelvis, and through a continuance of the peritoneal irritation adhesions gradually form about the outlet of the tube so that it becomes occluded. After the outer extremity of the tube is closed, unless the uterine extremity is sufficiently patulous for the gonorrheal pus to escape into the uterus (and this is unusual), the tube becomes distended and a pyosalpinx is formed. The inflammatory reaction produced by the pus, which escapes before the abdominal ostium has completely closed, affects not only the pelvic peritoneum but also the ovary. In the course of the inflammation the tube and the ovary become bound together and adherent to the pelvic peritoneum, in various positions, depending more or less upon their original relations to each other. Collections of pus may occur also between the end of the tube and the pelvic peritoneum. The ovary is usually affected by the gonococcal infection only in its superficial portion. The capsule becomes covered with inflammatory exudate, and as this more or less completely prevents the rupture of ripening follicles, the ovary often undergoes various degrees of cystic change. The developing cysts or a ruptured Graafian follicle may become infected from a contiguous pyosalpinx or from a pelvic collection of pus, and an ovarian abscess may result. This is exceptional. The pelvic lesions in gonorrheal affections are, as a rule, bilateral. One tube is commonly affected before the other, but unless the disease is treated promptly and the recurrent attacks are prevented, both tubes usually become involved.

The inflammation of the peritoneum in most of these cases remains confined to the pelvis, and under proper treatment shows little tendency to extend to the general peritoneal cavity. This fact depends largely upon the anatomy of the parts and upon the nature of the gonococcus. The ovaries and the tubes lie in Douglas' pouch, between the broad ligaments and the rectum. The great omentum and the sigmoid flexure dip down into the pelvis and cover the pelvic viscera more or less completely. Gonorrheal inflammation shows little tendency to extend along a serous surface—all of which helps to explain the frequency of the localization of gonorrheal peritonitis in the pelvis. Moreover, the serous surfaces of any of the structures named, when they are inflamed, have a tendency to adhere to the other surfaces in relation with them, and in this way, too, infected areas are quickly isolated and the spread of infection is checked. Although gonorrheal pelvic inflammatory disease does not usually extend beyond the bounds of the pelvis, its chief immediate danger lies in the degree to which it involves the pelvic peritoneum. Accordingly, we shall consider chiefly that form in which the peritoneum is involved. (For a discussion of Gonorrheal Salpingitis, see Chapter IV, page 305.)

GONORRHEAL PELVIC PERITONITIS.

Symptoms.—The symptoms of an attack of peritonitis often begin during or immediately after a menstrual period. Careful questioning will usually elicit the fact that the patient has had a leukorrheal discharge for some time which originated shortly after marriage or after suspicious intercourse. The condition is ushered in with severe, sharp pains in the lower abdomen, usually worse upon one side. If the attack begins during menstruation the flow may be arrested. Urination is frequent and painful, the bowels are constipated, and there is distention of the abdomen with tension or rigidity of the abdominal muscles. Nausea and vomiting may occur. The temperature varies between 101° and 103° F., and there is a proportionate increase in the pulse-rate—120 or 130 beats to the minute is not uncommon.

Diagnosis.—The diagnosis of gonorrheal pelvic peritonitis depends largely upon the history of the patient and upon the symptoms as they have been described. In case the history of gonococcus infection is not obtained from the patient and yet strongly suspected, confirmatory evidence can often be found by an examination of the urethra, the ducts of Bartholin's glands, and the cervix. Pelvic examination in the early stage is rather unsatisfactory, on account of the rigidity of the abdominal walls and the pain incident to a pelvic examination. Usually, however, it can be determined that the uterus is more or less fixed and that any attempt to move it causes intense pain. Another reason why the pelvic lesions are not palpable at this stage is found in the fact that unless the attack is a recurrent one, the disease of the pelvic organs is in a formative stage and has not as yet produced any definite inflammatory masses. Later on, when under appropriate treatment the distention of the abdomen has been relieved and the pain is less marked and the process has become more distinctly localized, the uterus will be found fixed either in a normal or in a retroverted position, and back of the uterus, usually on both sides, tubo-ovarian masses of various sizes and shapes will be recognized. It is often not possible to differentiate the tube from the ovary in these masses by bimanual examination, and fortunately it is not important to do so for the sake of treatment.

Differential Diagnosis between Gonorrheal Pelvic Peritonitis and Appendicitis.—It is most important to differentiate at times between gonorrheal pelvic peritonitis and appendicitis.¹ Gonorrheal pelvic peritonitis rarely has a fatal issue and in the acute stage it is amenable to medical treatment. Almost the contrary is true of appendicitis. The differentiation between the two is often easy. Sometimes it is necessary to observe the patient for twenty-four hours before the question can be decided. When the appendix hangs over the brim of the pelvis it may be involved in a gonorrheal pelvic peritonitis. In such a case, however, the prognosis, so far as the appendix itself is concerned, is no worse than that of the

¹Anspach, Brooke M.: "The Diagnosis and Treatment of Acute Pelvic Peritonitis of Gonorrheal Origin," New York Med. Jour. and Phila. Med. Jour., March 25, 1905.

gonorrheal peritonitis, the outer coats of the appendix only being involved, and the infecting organism (gonococcus) differing decidedly from the streptococcus or the bacillus coli communis of the ordinary appendicitis.

In appendicitis there is often a history of previous attacks associated with indiscretion in diet, habitual overeating, and chronic intestinal indigestion. The pain is at first not well localized, affecting more or less the entire upper abdomen. Later it becomes localized about the appendiceal region. The gastro-intestinal symptoms are more marked in appendicitis; nausea, vomiting, constipation, etc., are more pronounced and less apt to respond quickly to treatment. The pain and tenderness are at a higher point and more or less confined to the right side.

Prognosis.—The prognosis of gonorrheal pelvic peritonitis, so far as life is concerned, is good. Under symptomatic treatment the active symptoms subside in a few days. Unless the diseased structures are removed by operation, however, the attacks recur at more or less frequent intervals; and there is little tendency to a spontaneous cure. At times intraperitoneal abscesses form which must be evacuated before the attack will subside.

Treatment.—The patient should be put in bed. Food should be withheld until the acute symptoms subside. Epsom salts in a saturated solution (tablespoonful dose) should be exhibited every half hour, or every hour, until the bowels are freely moved. Either an ice-cap or hot fomentations in the shape of hot flaxseed poultices or turpentine stupes should be applied to the hypogastrium. The ice-cap is usually preferable, but in a given case the one which gives the greatest relief should be selected. Anodynes will not, as a rule, be required and should be avoided. Hot vaginal douches of normal salt solution should be given as soon as the initial symptoms are under control. The water should be at a temperature of 110° F.; or if a thermometer is not at hand, as hot as the physician or nurse can bear upon the forearm. The patient should lie on her back, with her head raised upon a pillow and her buttocks raised upon the stage of the douche pan. The douche nozzle, of the variety already described (page 216), should be gently inserted into the vagina as far as it will go without producing any pain. The douche-bag should be elevated but little above the plane of the patient and not more than two feet at most. With this slight elevation the water flows into the vagina slowly and causes no pain; the bag should be kept replenished with hot solution until the heat and the moisture have been applied to the vaginal vault for from twenty minutes to half an hour. In early cases this douche may be repeated every six hours; in later ones, two or three times a day. No food should be given until the bowels have been thoroughly moved, the abdominal distention has been relieved, and the physician is satisfied that he is not dealing with an inflammation of the vermiform appendix. After excluding appendicitis, a liquid diet may be given, and the food may be increased as the patient's condition improves. Under this plan of treatment, usually within three days, even the most alarming cases of gonorrheal pelvic peritonitis will undergo a very marked improvement. The temperature will fall to the normal, the pulse-rate will correspondingly decline, pain in the lower abdomen will disappear, nausea

and vomiting will cease, and the patient will express herself as feeling tolerably well.

In cases in which the differentiation between appendicitis and pelvic peritonitis is doubtful, if the abdominal distention, nausea, vomiting, and pain directly over the appendix are not relieved within twenty-four hours after the measures advised have been carried out, it is best to resort at once to abdominal section. Abdominal section during the acute attack is almost never indicated in cases of gonorrheal pelvic peritonitis; only the rare cases in which peritonitis spreads and tends to become general require an early operation. Should a localized collection of pus form in the pelvis it should be incised and drained from the vagina. In the purely gonorrheal cases, after the acute symptoms have subsided, an examination will reveal tubo-ovarian inflammatory masses in the pelvis such as have already been described. In almost every case of gonorrheal salpingitis an operation to remove at least one or both tubes will ultimately be required; because if the infected tubes are allowed to remain it is nearly certain that the patient will have recurrent attacks of peritonitis. The recurrent attacks and the more or less constant pain and discomfort break down the patient's health and render her an invalid; a fatal result may finally ensue, when the patient has become reduced in strength and visceral complications have occurred.

The best time for an operation is after the acute attack has subsided and the exudate has been absorbed. The patient should be kept in bed until this result has been accomplished, and then she should be exposed to operation. If, for any reason, an operation is declined or seems inadvisable, the subsequent treatment of the patient should include rest in bed and the use of hot douches until there is no pain upon attempts at walking. After the patient is upon her feet, the use of glycerite of boroglycerin tampons three times weekly and vaginal douches of hot saline solution are advisable.

A spontaneous cure of gonorrheal salpingitis almost never occurs, and a relative cure with freedom from pain and from recurrent attacks of salpingitis and peritonitis is rare.

PUERPERAL PELVIC INFLAMMATORY DISEASE.

Etiology and Pathology.—Pelvic inflammatory disease of this variety is due to the introduction of infectious material into the genital tract, usually into the uterus, after labor, miscarriage, or abortion. It may also originate from septic foci, already present in the pelvis, which have been compressed, ruptured, or otherwise injured by the processes of labor or abortion. The organism commonly involved is the streptococcus, the staphylococcus, or the bacillus coli communis; the gonococcus and the saprophytic organisms are also occasionally concerned. In contradistinction to the gonococcus, which, as a rule, travels along the mucous membranes of the genital tract and shows feeble powers of penetration, the streptococcus usually penetrates the uterine wall from its point of inoculation; the organism may also infect the venous thrombi at the placental site. Less often it travels

along the mucosa of the uterine cornua into the tubes. Most frequently the streptococcus passes by means of the lymphatic channels directly through the uterine wall. In its passage it may produce localized areas of suppuration in the myometrium.

When the infection is inoculated upon wounds or abrasions within the cervical canal, or just above the internal os, it is very apt to produce a lymphangitis, which extends through the uterine wall into the cellular tissue at the base of the broad ligaments. (For a discussion of the pelvic cellulitis or parametritis thus produced, see Acute Pelvic Cellulitis, page 298.)

When the infection is deposited at a higher point, it may penetrate the uterine wall and directly involve the peritoneum of the pelvis and the pelvic viscera. This results in an inflammation of the outer surfaces of the tubes and the ovaries (perisalpingitis, perioöphoritis) and the formation of an inflammatory peritoneal exudate which binds the tube and the ovary to each other and to the peritoneum in a dense mass, wherein it is sometimes difficult to distinguish one organ from the other. The infection need not be confined to either the cellular tissue or to the pelvic peritoneum and viscera. It may affect them both. When the cellular tissue is involved alone at first, there is very often a secondary extension of the inflammation through the overlying pelvic peritoneum, producing adhesions but no gross alterations of the adnexa. Or an abscess of the ovary may be produced either singly or in combination with a cellulitis; in both instances the infectious germs reach that organ by extension along the lymphatics.

Collections of pus inside the tubes are not common in puerperal cases, for the spread of such an infection along the mucous membranes is the exception rather than the rule. If the infection is of a mild type, it may be more or less localized in the inner layers of the myometrium or in the remains of the endometrium. Such cases are often incorrectly regarded as cases of sapremia.

Pyogenic organisms produce not only local but also general lesions. The latter result from the absorption into the general circulation of the toxic products of the infectious organism, or of the organism itself. When the toxins alone are absorbed, the condition is spoken of as a toxemia; when the bacteria also are present in the blood-stream, the condition is known as bacteriemia. The patient may die as the result of either of these conditions even though the local evidence of infection is either very slight or *nil*.

It has already been said in reference to gonorrheal pelvic inflammatory disease that peritonitis is its most serious manifestation. Peritonitis is also one of the gravest forms of puerperal inflammatory disease, although it is neither so common nor so fatal as the forms in which toxemia or bacteriemia play the largest part. The forms of puerperal inflammation in which toxemia and bacteriemia play a large part belong more to the subject of obstetrics. We shall consider the subject of puerperal inflammatory disease from the standpoint principally of peritonitis. The reader should not forget that the adnexa are usually involved with the peritoneum.

PUERPERAL PELVIC PERITONITIS.

Symptoms.—The trouble dates from labor or from abortion, or it occurs after some intrauterine manipulation or operation during pregnancy. The disease is either suddenly ushered in by a chill and by pyrexia of an alarming degree, sometimes as high as 105° F., or the fever gradually develops during the first days of the puerperium. The pulse-rate is usually greater than would correspond to the degree of temperature. Indeed, the first symptoms of puerperal infection may be an undue rapidity of the pulse. There may be actual chills associated with hyperpyrexia, or merely chilly sensations without any marked variation in the temperature curve. The patient complains of pain in the lower abdomen, worse perhaps upon one side. In many cases the degree of pain is very slight. The abdomen is distended and there is more or less tenderness. Constipation is the rule, although there may be diarrhea later in the more septic cases. Headache is quite common. Nausea and vomiting are usual symptoms. The lochial discharge is usually diminished in amount. In the more severe form of infection, which often gives rise to peritonitis or to cellulitis, there is usually no decidedly foul odor to the discharge. If, however, necrotic material exists within the uterine cavity, this symptom will be present.

Diagnosis.—This type of peritonitis follows labor, abortion, or some uterine operation or instrumentation during pregnancy. The history of the case will show the possibility of a direct inoculation with pyogenic organisms. In cases due to attempts at producing abortion, the patient will often deliberately deceive the physician. He is then able to judge only by the symptoms. As a rule, with the exception of pain, the symptoms are much more violent than in the gonorrheal form of peritonitis. There is often but little pain. The general symptoms of intoxication, however, such as pyrexia, rapidity of the pulse, etc., are always greater than in the gonorrheal form. The disease may manifest itself within a few hours of the infection or at any time within a week. Usually the symptoms are well developed by the third day. In puerperal cases, and in those which follow attempts to induce abortion, the nature of the illness will admit of little doubt. In the other cases, especially when there is an effort to deceive, the patient should be closely questioned concerning the menstrual periods. Sometimes the history of a recent irregularity or of an absence of the menses will direct attention to the possibility of pregnancy and an attempt to produce abortion.

Pelvic examination may be unsatisfactory during the first few days because of tenderness and because no definite masses of exudate have as yet been formed. In cases which follow the termination of pregnancy the uterus will be found enlarged and softened; the os is patulous. Involution does not progress with its customary rapidity. After the initial stage has passed, and structural changes have occurred, pelvic examination will yield positive evidence. Thus the uterus will be found more or less fixed and displaced by pelvic masses which are present on one or both sides of or behind the uterus. The result of bimanual palpation

will depend, of course, upon the structural changes which have occurred. At first the pelvic masses have an almost stony hardness; this may be replaced later by softening, if suppuration occurs. It is nearly impossible to differentiate a tubal from an ovarian enlargement. With either there is, as a rule, a peritoneal exudate which obscures the outlines of the adnexal tumor; usually, however, the pelvic mass can be outlined as distinct and separate from the uterus.

It will be found that the disease is less frequently bilateral than is true of gonorrheal pelvic peritonitis. Sometimes, also, there is an associated infection of the parametrium (for the physical signs see Cellulitis, page 300). This almost never occurs in the purely gonorrheal form. An ovarian abscess is nearly always the result of puerperal infection, but it is very often, if not usually, impossible to differentiate between a tubal and an ovarian enlargement in an inflammatory case. In the most severe cases of puerperal pelvic peritonitis the local changes are slight, while the toxemia or bacteriemia is pronounced, so that the patient may perish before pelvic lesions can be recognized by bimanual palpation.

Prognosis.—The prognosis is decidedly more grave in puerperal than in gonorrheal pelvic peritonitis. The danger lies partly in a rapid absorption of the infectious organism, or of its toxins, or of both, and partly in a general septic peritonitis. The prognosis is of necessity dependent to a considerable degree upon the virulence of the infecting organism and upon the strength of the patient. An estimation of the white blood-corpuscles may be of some value as an indication of the resistance to the infection. One of the authors observed a case of septic pelvic peritonitis in which, with the most severe general symptoms, there was a leukocytosis of 45,000. The patient recovered. In the presence of pronounced general septic symptoms and no increase, or at most a very slight increase, in the leukocytes, the prognosis is usually bad. The worst cases are those in which pelvic exudates are slow in appearing or do not appear at all. The patient under such circumstances suffers from the presence within the blood-stream of the infectious organism and its products, a condition known as bacteriemia. If the toxin alone is present the prognosis is less serious. Blood cultures, if possible, should be made in every case to determine whether there are bacteria in the blood-stream. If the streptococcus is found the outlook is dubious; the staphylococcus and the bacillus coli communis are less dangerous, although bacteriemia of any variety is often fatal.

If the infection becomes localized in the pelvis and results in an abscess of the ovary, of the tube, or of the cellular tissue, or produces a pelvic exudate, the prognosis is usually better than in those cases where no such localization occurs. The simple evacuation of the collection of pus in the former case will, as a rule, result in an immediate improvement in the general condition and be followed by a resolution of all of the surrounding inflammatory changes in the pelvic organs. The parts return rapidly and more or less perfectly to the normal. Adhesions disappear and a perfect anatomic cure results in many cases. In others permanent structural lesions remain, but the inflammatory process is at an end and the patient is comfortable. In a few, the lesions and adhesions are serious enough to produce

a considerable amount of pelvic distress, and when all the pus has not been evacuated, the inflammatory process progresses or becomes recurrent.

Treatment.—The first thing to consider is the advisability of disturbing the interior of the uterus. Any intrauterine manipulation may do much harm by breaking down the protecting layer of white blood-cells, which may have formed beneath the endometrium, and opening up new channels of invasion. It is extremely hard to say in some cases whether there is not some necrotic material within the uterus, in which infectious organisms are swarming and from which toxins are being absorbed. A good practical rule to follow is that in the presence of a lochial discharge which is of a dark color, frothy, or of a more or less putrid odor, the interior of the uterus should be explored thoroughly with the finger, under general anesthesia, and that pieces of tissue, hypertrophied decidua, or any necrotic masses should be removed by means of the finger, the placental forceps, or the dull curet. The cavity of the uterus should then be irrigated with formaldehyd solution (1:4000), followed by normal salt solution.

After determining whether necrotic or infected tissue exists within the uterine cavity and managing the case accordingly, there are certain general principles to be followed in the subsequent treatment. In the first place, the strength of the individual must be conserved in every possible way. To this end a concentrated and nutritious diet should be given. Milk, broths, koumyss, eggs beaten up with milk or broths, predigested beef, liquid peptonoids, panopeptone, or any of the highly concentrated, nourishing forms of food should be systematically given, in such quantities as the stomach will tolerate. The exhibition of drugs by mouth should be guarded so that the stomach can be kept in good condition for the digestion of food. The stimulation of the patient should be regulated by her general condition. Stimulants should be given in small quantities at first and gradually increased, if necessary. Strychnin sulphate, gr. $\frac{1}{60}$ every four hours, may be gradually increased to gr. $\frac{1}{30}$ every three hours; whisky, brandy, and champagne are often of great service. Digitalis, caffenin, and atropin may be used if more stimulation is required. Camphor in the form of camphorated oil (1 gr. to 10 minims of olive oil) is a valuable heart stimulant and should be administered hypodermically in extreme cases. Stimulation should not be started early, unless there is great weakness or other evidence of toxemia. In the later stage of every serious case stimulants will be required, but until they are actually needed they should be withheld.

It is well at the outset to secure a thorough evacuation of the bowels; the administration of calomel, followed by a saturated solution of Epsom salts, will usually effect this result. If diarrhea is present it should be regarded as an effort on the part of nature to eliminate the poison, and it should be controlled, but not checked unless it weakens the patient. The use of quinin in moderate dose is of value. Phenacetin and the other coal-tar preparations are objectionable. The temperature can be controlled by the use of cold sponge baths and ice-bags. If the patient complains of headache, an ice-cap should be applied.

Oftentimes the application of cold to the abdomen will serve the double purpose of relieving pain and of lowering temperature. Ergot is valuable in most of the cases when administered during the first few days, as it produces uterine contractions and thus tends to diminish the patency of the lymphatic channels in the wall of the uterus, through which toxins are absorbed. It also aids in the expulsion from the uterus of clots and of putrid lochial discharges, from which absorption might occur. The value of the use of salt solution in these cases is very great. The best way to administer it is subcutaneously; 1 liter of a normal salt solution can be given every six hours. If the subcutaneous injection of salt solution is too painful, or objectionable for any other reason, the use of saline enemata, given with the hips elevated, from one-fourth to one liter every three to six hours, will answer a similar purpose.

The use of antistreptococcic serum, proposed in 1895 by Marmorek,¹ has been disappointing. Williams (*loc. cit.*) relates that in May, 1899, a committee of the American Gynecological Society, of which he was chairman, made an exhaustive report of this subject, giving the complete literature and collecting all of the cases. They found that in 352 cases of puerperal infection there were 73 deaths, a mortality of 20.74 per cent. In a large number of these cases it was not positive that the cause of the infection was the streptococcus, but in 101 in which the streptococcus was demonstrated 33 deaths occurred, a mortality of 32.69 per cent. According to Edgar,² the method is still on trial and it may be used. He says that it is necessary to exhibit the remedy in large doses. The initial injection should be 20 c.c. while the daily dose should be 60 c.c. in desperate cases. According to J. S. Evans, the initial dose should be 80 c.c.; this should be repeated every six hours until 320 c.c. have been given during the first twenty-four hours. The serum can be used scientifically only when a bacteriologic examination of the uterine contents or an examination of the blood has proved the streptococcus to be present. In desperate cases, as the serum apparently does no harm, it may be tried.

Credé's ointment may be used, 15 to 45 grains at a time being rubbed into the inner side of the thighs once or twice daily. The ointment should be well rubbed in, twenty minutes being occupied in the process; and the anointed area should be covered with rubber tissue. Hirst³ advises the use of nuclein in an effort to increase the number of white blood-cells, in this way producing an artificial hyperleukocytosis, so that the normal phagocytic power of the blood is increased. Hofbauer⁴ reports several remarkable cures from the use of nuclein. Hirst (*loc. cit.*) for some years has administered nuclein as a part of his treatment of puerperal sepsis. Nuclein is furnished in the form of a 5 per cent. solution, of which the dose is 10 to 60 minims hypodermically. The injection of solutions of

¹ Marmorek: "Sur le streptocoque," *Comptes rendus de la Soc. de Biol.*, 1895, 10me série ii, 122; "Streptocoque et le sérum antistreptococcique," *Annales de l'Institut Pasteur*, 1895, ix, 593.

² Edgar, J. Clifton: "The Practice of Obstetrics," 2d edition., Phila., 1904.

³ Hirst, B. C.: "A Text-Book of Obstetrics," Phila., 1903.

⁴ Hofbauer, J.: "Zur Verwerthung einer Künstlichen Leukocytose bei der Behandlung septischer Puerperalprocesse," *Centralbl. f. Gynäk.*, 1896, Nr. 17, S. 441.

corrosive sublimate into the veins in puerperal sepsis was advocated in 1894 by Kezmarsky,¹ and the injection of formalin by Barrows² in 1903. With both these methods successes and failures have been reported. Further experience is necessary to prove their value. The authors believe that neither method is justifiable and prefer the use of normal salt solution either by enema or by hypodermoclysis.

The application to the interior of the uterus of disinfecting solutions should be carefully made. Whatever good can be accomplished with intrauterine irrigations must be effected during the first two or three days. Later, after the formation of exudates, irrigations are more apt to do harm than good. Moreover, at this stage the bacteria have advanced beyond the possible action of any solutions applied to the interior of the uterus. The irrigation of the uterine cavity with 50 per cent. solution of alcohol has been recommended. The same treatment has been combined with an intrauterine gauze pack. Irrigation of the uterine cavity with disinfecting solutions, such as bichlorid of mercury, is said to have caused fatal poisoning; even a single irrigation has been blamed for this unhappy result. An investigation of these cases would probably show that either a very strong solution was used or that a large quantity of the solution was allowed to remain in the uterus or the vagina.

The value of antiseptic intrauterine irrigations is a disputed question, but we believe that irrigation of the uterus with a bichlorid of mercury solution, 1:4000, or with a formaldehyd solution, 1:4000, *followed by normal salt solution*, daily for two or three days, will do no harm and may do much good. Irrigations should not be employed at a later date unless the character of the discharge shows that putrefaction is taking place within the cavity of the uterus.

Edgar (*loc. cit.*) has found the use of ichthyol of some value in cases in which there has been retention of placental tissue. After irrigating the uterus with normal salt solution he packs it with gauze soaked in a 50 per cent. ichthyol solution. He leaves the ichthyol gauze in the uterus for twenty-four hours, removes it, irrigates with a saline solution, and then repacks; the packing should not be tightly introduced.

As a rule, operative treatment is not advisable in puerperal peritonitis unless distinct inflammatory lesions of the pelvic organs can be felt by palpation. If the symptoms become progressively worse and an enlargement or an exudate or an abscess can be felt upon one or both sides of the pelvis, vaginal section with the evacuation of any collections of pus is decidedly preferable to any operation by the abdominal route. The prognosis of any abdominal operation for puerperal sepsis done early in the puerperium is extremely unfavorable. A striking and very important difference between gonorrhcal and puerperal pelvic inflammation is, that the end result of pyogenic infections which do not terminate fatally is far better than the result in the gonorrheal cases. In pyogenic cases the

¹v. Kezmarsky, Theod.: "Intravenöse Sublimatinjection (Bacelli) bei venöser Sepsis im Wochenbette," *Centralbl. f. Gyn.*, 1894, S. 906.

²Barrows, C. C.: "Report of a Case of Acute Sepsis," *Trans. of N. Y. Obstet. Soc., Amer. Jour. of Obstet.*, March, 1903, vol. xlvii, No. 3, p. 366.

pelvic organs may return entirely to the normal, after the subsidence of the inflammation, even though extensive pelvic exudates have been present during the acute attack. Adhesions between neighboring organs may become entirely absorbed, so that months or years afterward a pelvic examination does not show the slightest evidence of the previous affection. For this reason the removal of organs for puerperal infection is seldom indicated or permissible. This practice and these results are in marked contrast to those which obtain in gonorrheal inflammation.

CHRONIC PELVIC PERITONITIS.

Etiology and Pathology.—Chronic pelvic peritonitis is a term used to denote the residuum of a previous acute inflammation of the peritoneum or that form of low-grade inflammation of the peritoneum which results from long-continued irritation. The essential lesion in either case is found in the adhesions which bind the pelvic viscera to the pelvic wall and floor.

As has already been said, in the favorable cases of puerperal inflammatory disease the infecting germs ultimately die, and most of the adhesions and the structural alterations which have occurred during the acute attack undergo absorption, so that the parts return to a normal or to an approximately normal state. In the gonorrheal cases, on the contrary, the infection is very apt to be persistent and to remain more or less active over a considerable length of time, producing recurrent exacerbations of pelvic peritonitis until the patient is relieved by operation. Very exceptionally it is possible that gonorrheal pelvic disease may heal spontaneously through the resolution of the inflammatory process; this is more apt to occur as the result of age and the atrophy of the pelvic organs which is incident to it. The persistence of gonorrheal infection is explained in part at least by the fact that it often produces a pyosalpinx. A pyosalpinx is unlike the ordinary abscess in that it is commonly made up of several loculi, and its lining consists of the inflamed and distorted mucous membrane. The accumulation of pus forms more slowly than in an ordinary abscess and is largely measured by the severity of the suppurative lesion of the mucosa. Again, if in some way the pus is discharged or evacuated from the pyosalpinx, in a short time there is a reaccumulation of it from the diseased and discharging mucosa which lines the abscess sac, or from a loculus which has not been reached. Although in old cases of pyosalpinx the pus is sterile and all of the organisms are dead, yet the lesion is there, and this and the toxin liberated by the death of the gonococcus¹ keep on producing symptoms. In puerperal infection, or in forms other than gonorrheal, pyosalpinx is the exception rather than the rule. Chronic irritation of the pelvic peritoneum by the rubbing of a uterine or an ovarian tumor, or a displaced uterus, etc., may result in the slow formation of adhesions which bind the pelvic viscera together and produce various lesions of the tubes and the ovaries.

Symptoms.—The symptoms of chronic pelvic peritonitis are produced by the

¹ Landau, Theo.: *Verhandl. Berl. med. Gesellsch. Berl. med. Wochenschr.*, 1897, Nr. 32, S. 700.

adhesions which bind the organs together in a false position, and from complicating diseases of the tube and of the ovary.

It may be said in a general way that women with chronic pelvic peritonitis suffer from backache, pain extending into the thighs, pain in the lower abdomen, constipation, pain during defecation, and from frequent and painful micturition. The menstrual flow is apt to be painful, irregular, and profuse, and very often there is a persistent leukorrhea.

Diagnosis.—The diagnosis depends upon the history, the symptoms, and the discovery by bimanual palpation of a uterine displacement with adhesions or of an adherent tubal or ovarian mass. (For a full discussion see Chapter XIII.)

Treatment.—As a rule, the only treatment which does any good is an operation to remove or correct the abnormal conditions which are present. If the disease is due to chronic mechanical irritation, or if it has resulted from gonorrheal peritonitis or puerperal peritonitis and the infection has entirely died out (this is very exceptional in the gonorrheal form), the local treatment by means of tampons and douches, and the general treatment, described on page 270, may be used in an effort to deplete the pelvic organs and to make the patient comfortable. Pelvic massage (page 223) will be applicable in a very small proportion of the cases.

PROLAPSUS OF THE OVARY.

For the etiology, diagnosis, symptoms, and operative treatment see Chapter VI. If there are no adhesions the condition may be temporarily relieved by the introduction of tampons in the knee-chest or in the Sims position. Pessaries should not be used in these cases even though the prolapsus of the ovary is coincident with retroposition of the uterus. The posterior bar is quite apt to press upon the organ and cause pain or even inflammation and the formation of adhesions. The persistent use of the tampon together with the restoration of the general health will cure a considerable percentage of cases of prolapse of the ovary.

PELVIC CELLULITIS, LYMPHANGITIS, PARAMETRITIS.

Introduction.—At the sides and on the floor of the pelvis, between the peritoneum of the pelvis and the fascia which it overlies, there is a layer of loose fibro-areolar tissue. This is spoken of as the pelvic cellular tissue. In certain areas where from the reduplication of the peritoneum there is a considerable interval between it and the pelvic wall or floor, this tissue is greater in amount and forms a more or less distinct structure. These especially well-developed parts of the pelvic cellular tissue are given names which describe their position. Thus, the cellular tissue between the peritoneal covering of the broad ligament, extending to the pelvic wall and to the pelvic floor, is spoken of as the *parametrium*. Between the folds of peritoneum, which form the uterosacral ligaments and the pelvic floor and sacrum, the cellular tissue is spoken of as the *paraproctium*. Surrounding the upper part of the vagina, and extending from the bases of the parametrium to the attachment between the vagina and the bladder, rectum, and levator fascia,

the cellular tissue is spoken of as the *paracolpium*. The cellular tissue between the folds of the uterovesical ligaments and the cervix and the superior surface of the bladder is called the *paracystium*. The most important vascular channels which supply the pelvic viscera run through this cellular tissue and are supported and sheathed by extensions and prolongations of it. The lymphatic channels from the uterus, especially those from the cervix and from the upper part of the vagina and the base of the bladder, course through it on their way to the pelvic lymph-glands. This cellular tissue, from its position and from the lymphatics and the venous channels which it carries, is exposed to traumatism and to infection. Cellulitis may occur as the result of either; it is much more commonly due to infection.

Traumatic Cellulitis.—*Etiology and Pathology.*—Cellulitis of an acute type may result from pressure or from tears during labor. It may also result from the traumatism incident to the use of an ill-fitting pessary which bruises the cellular tissue of the uterosacral ligaments or the paracolpium. Acute traumatic cellulitis, unless complicated by infection, is not very troublesome and subsides in a few days. In this condition there is very often thrombosis of the veins of the cellular tissue, which becomes swollen and edematous. This type of cellulitis corresponds to the bruise or contusion so often encountered in the subcutaneous connective tissue.

Under the influence of rest and the removal of the offending cause, in the absence of infection, the condition subsides in a few days. When cellulitis is caused by extensive lacerations of the cervix reaching into the surrounding cellular tissue, the inflammatory reaction is similar to that attending a fresh wound in any part of the body. Unless infection occurs, union takes place by first intention, and when the parts unite in their proper position and relation but little harm is done. If there is infection or great bruising of the parts, so that they are partially devitalized, sloughing may result. In such event, during the process of healing, scar tissue is formed which may distort the upper part of the vagina, and by pulling upon the cervix may cause various malpositions and flexions of the uterus.

Symptoms.—The symptoms of traumatic cellulitis may escape observation, the slight rise of temperature and pulse being easily regarded as normal during the first days of the puerperium. There may be some pain upon motion and the parts may be excessively tender to palpation. A certain amount of traumatic cellulitis or contusion possibly occurs in every prolonged labor. In the severer forms, associated with extensive lacerations or sloughing, it is almost impossible to prevent infection; the symptoms then become those of septic cellulitis. Upon palpation, the bases of the broad ligaments feel swollen and edematous. The patient complains of tenderness. Laceration through the cervical lips into the cellular tissue can be recognized by more or less severe hemorrhage and by direct palpation or by inspection of the cervix and the vaginal vault.

Diagnosis.—The diagnosis depends upon the slight constitutional disturbance associated with the local symptoms of extensive bruising or laceration of the tissues.

Treatment.—Traumatic cellulitis associated with deep laceration of the cellular tissue, calls for surgical attention and need not be discussed. In the form due to bruising only, all that is required is rest in bed, the exhibition of salines, and the use of hot vaginal irrigations of a solution of bichlorid of mercury (1:10,000) given with every aseptic precaution, and followed by an irrigation with sterile salt solution. Great care should be taken to protect the vulva by means of an occlusive gauze dressing from any outside contamination.

SEPTIC CELLULITIS.

Etiology and Pathology.—Septic cellulitis in the great majority of cases arises from an infection which complicates labor or abortion. The infection is sometimes produced by intrauterine instrumentation or operation. Infected wounds following vaginal or perineal operations may also give rise to cellulitis.

When the disease is associated with labor or abortion, very often there are lacerations of the cervix which extend more or less deeply into the cervix, or entirely through it and into the parametrium. The infectious organism, whatever its origin and wherever deposited, gains access to the cellular tissue by way of the lymphatics or the veins. Primarily the disease is either a lymphangitis or a thrombophlebitis, attacking the vessels which pass from the site of the infection through the base of the broad ligament. Whatever its primary form, later all of the constituents of the cellular tissue are involved in the inflammation.

For a long time cellulitis was regarded as the common inflammatory lesion of the female pelvis. Bernutz¹ first showed by his very careful observations at autopsy that most of the (at that time) so-called cases of peri-uterine cellulitis were actually cases of pelvic peritonitis combined with tubal and ovarian disease. Bernutz (*loc. cit.*) did not deny the occurrence of puerperal pelvic cellulitis, but regarded its occurrence as a well-attested fact, which indeed he had himself demonstrated by autopsies. Although Bernutz had called attention to the error of regarding most cases of pelvic inflammation as cellulitis, this erroneous doctrine continued to be held in America, largely as a result of the positive teaching and the great influence of Emmet.² Tait³ and his followers went to the other extreme and claimed that pelvic inflammatory disease was confined to the peritoneum and to the uterine adnexa. This view was maintained for a time by Price,⁴ Baldy,⁵ Polk⁶ and many others in this country. It was denied that pelvic cellu-

¹ Bernutz, Gustave: "Pelvi-Peritonitis: Clinical Memoirs on the Diseases of Women," Bernutz and Goupil, vol. xi; edited by Alfred Meadows; The New Sydenham Society, London, 1867.

² Emmet, Thomas Addis: "Pelvic Inflammations; or, Cellulitis *versus* Peritonitis," Trans. Amer. Gynec. Soc., vol. ii, 1887, p. 101.

³ Tait, Lawson: "Diseases of Women and Abdominal Surgery," p. 132, Phila., 1889.

⁴ Price, Joseph: Discussion, Obstetrical Society of Philadelphia, Annals of Gynecology and Pediatrics, January, 1893, p. 239.

⁵ Baldy, J. M.: Trans. Obst. Soc. of Phila., May 4, 1893; Annal. Gynec. and Pediat., vol. vi, No. 9, June, 1893, p. 558.

⁶ Polk, W. M.: "Periuterine Inflammation," Trans. Assoc. Amer. Physicians, p. 145, Phila., 1886.

tis occurred, or, if at all, merely as a secondary result of pyosalpinx or abscess of the ovary. One of the authors¹ in the years 1891-1894 reported a number of undoubted instances of puerperal pelvic cellulitis, with or without suppuration (phlegmon), in which the diagnosis was confirmed by abdominal section, and the uterine appendages were found to be normal or approximately normal. Noble² also reported, in 1895, 16 cases in which the same facts were proved by abdominal section in the hands of nine other gynecologists.³ Since that time the reality of the affection is no longer disputed, and it has become a well recognized form of pelvic inflammation.

When the infecting organism gains access to the cellular tissue of the broad ligament, an infiltration of the parts with small round cells and polymorphonuclear leukocytes very soon occurs. This inflammatory infiltrate gives a stony hardness to the tissues and fixes the pelvic organs in relation to it. The induration usually extends from the uterus to the pelvic walls and fuses with the fascia and the muscles overlying the bony pelvis. The infection is often confined to one side of the pelvis, *i. e.*, to one broad ligament. It may be found on both sides. It is not uncommon, when unilateral, for it to involve the uterosacral ligament on the affected side posteriorly (the paraproctium), and the uterovesical ligament on the affected side anteriorly (the paracystium). It may also involve the paracystium or the paraproctium alone. The paracolpium is especially invaded when the infection occurs from a wound of the vagina or the perineum. The part of the cellular tissue which is affected depends wholly upon the spot at which the inoculation occurs, and the course of the lymph-vessels or the veins from that area. As has been said before in the consideration of puerperal peritonitis, cellulitis and peritonitis are often combined. The two diseases either occur at the same time or more commonly the peritonitis is secondary to the cellulitis, and results from a direct extension of the inflammation from the cellular tissue to the pelvic peritoneum. The reverse is true when cellulitis is secondary to pyosalpinx or to abscess of the ovary.

The inflammatory exudate in the cellular tissue either undergoes resolution and becomes gradually and completely absorbed, in the favorable cases, or it softens and forms an abscess (phlegmon). In some of the worst forms of infection the infectious product may pass through the lymphatics of the broad ligament into the general circulation without producing any noteworthy local reaction, so that the patient perishes with all of the septic symptoms of puerperal infection; and yet there may be no palpable lesion in the pelvis. In case of abscess formation (phlegmon) the pus, as a rule, burrows along the wall of the vagina, causing the vaginal fornix to bulge, and if not released by incision it bursts into the vagina or into the rectum. The pus may also be discharged into the bladder, or rarely into an

¹ Noble, C. P.: "Four Cases of True Pelvic Abscess," *Medical News*, August 29, 1891, p. 237; "Acute Puerperal Cellulitis and True Pelvic Abscess," *Amer. Jour. Obstet.*, 1894, vol. xxix, p. 447.

² *Ibid.*: "Puerperal Pelvic Cellulitis and Puerperal Peritonitis," *Amer. Gynec. and Obstet. Jour.*, January, 1895.

³ Hirst, Boldt, Polk, Coe, Etheridge, Kelly, MacLaren, Cushing, Mann.

adherent loop of intestine, or indeed into the free peritoneal cavity. A parametritic phlegmon being extraperitoneal, the pus may lift up the uterovesical peritoneum, gaining access to the cellular tissue behind the symphysis and presenting itself in the median line of the abdomen just above the pubes. Or it may pass laterally, burrowing under the peritoneum reflected from the upper surface of the round ligament to the anterior abdominal wall, and by way of the inguinal canal make its appearance in the groin above Poupart's ligament. Rarely it may pass behind the posterior layer of the pelvic peritoneum to the mesosigmoid and present itself externally in the loin. Cases are on record where the pus has burrowed through the pelvic fascia from the paracolpium and the paraproctium to the ischio-rectal fossa. When such collections of pus are discharged spontaneously the abscess cavity rapidly closes and the patient usually makes a prompt recovery. The chronic discharging pelvic abscesses which persist for years are usually tubal or ovarian collections of pus and not abscesses in the cellular tissue.

Symptoms.—The subjective symptoms of septic puerperal cellulitis are similar to those of puerperal peritonitis (page 290). As the peritoneum is not involved or is involved only secondarily, there is usually less pain, and the symptoms are more localized in the pelvis. If suppuration occurs, the general symptoms are less alarming than in suppuration within the peritoneum; the temperature assumes a hectic type, unless prompt incision is practised. When the paraproctium is involved the exudate may cause symptoms of obstruction of the rectum; when the paracystium is involved the bladder is usually irritable and frequent micturition becomes a symptom.

The objective signs show some variation from those of peritonitis. It should be remarked that in cases of peritonitis with a considerable amount of plastic exudate, the differential diagnosis may be nearly or quite impossible. Upon bimanual palpation the vault of the vagina on one or both sides, or entirely around the cervix, feels densely hard. The mucosa feels as if it closely overlaid tissues carved out of wood. The cervix feels as if frozen into an area of dense induration which extends without interruption to the bony pelvic wall. The uterus may be absolutely fixed if both broad ligaments are involved.

Examination per rectum will show the same dense hardness of the pelvic mass. At the point where the uterosacral ligaments pass about the rectum if the exudate involves the paraproctium, there will be some narrowing of the lumen of the bowel; to the palpating finger this will feel like an auger-hole in a board, covered with the rectal mucosa. The induration sometimes may be felt to extend along the sides or the front of the pelvis, in the directions indicated, or laterally above Poupart's ligament in the median line above the symphysis. If suppuration occurs the parts lose their stony hardness, and fluctuation becomes manifest within several days. When the abscess is not large and does not bulge into the vagina, it may be difficult to detect fluctuation. In such cases the tissues of the vaginal vault may feel edematous and there may be slight pitting upon pressure. Quite frequently the abscess will point at one side of the vault of the vagina.

Diagnosis.—The mass in pelvic cellulitis, as contrasted with that in pelvic peritonitis, is more apt to extend continuously from the cervix to the pelvic wall and to be *firmly fixed to the bony pelvis*. In peritonitis the mass can often be recognized as occupying a position posterior to the broad ligament. When there is much exudate associated with pelvic peritonitis, the differential diagnosis is more difficult or impossible. In such cases the pelvic mass is apt to fill up Douglas' pouch and press the anterior rectal wall backward, instead of surrounding it as it does in cellulitis. In puerperal cases an abscess of the ovary and a pelvic peritonitis may be associated with a phlegmon of the broad ligament. In non-puerperal cases a pyosalpinx or an abscess of the ovary may be the cause of a broad ligament cellulitis or of a secondary abscess. The diagnosis can be made best when the case is watched during its development.

Treatment.—The general treatment of septic or of puerperal cellulitis differs but little from that of puerperal pelvic peritonitis. Under the influence of rest in bed, laxatives, the application of an ice-cap to the hypogastrium, hot douches, quinin, and strychnin, a considerable percentage of cases of puerperal pelvic cellulitis undergo resolution and spontaneous recovery.

Exudates filling half the pelvis at times disappear. When pus forms it should be evacuated promptly; an incision sometimes hastens absorption in the case of large exudates even though suppuration has not occurred. Whenever possible the broad ligament should be opened from the vagina, the folds of the broad ligament being separated with the fingers, when necessary, in order to reach deep-seated abscesses. At times the incision must be made in the groin or in the loin.

CHRONIC PELVIC CELLULITIS.

Chronic cellulitis occasionally occurs as the sequel of an acute attack. In some of these cases there is an actual chronic inflammation of the cellular tissue and areas which show inflammatory infiltration may be found by a painstaking microscopic examination. In other cases the inflammatory process has ceased, but there is left in the cellular tissues a residuum of hyperplastic or cicatricial tissue. It is often impossible to distinguish clinically between these two forms. According to Ill,¹ cellulitis may also be chronic from the beginning. Thus, ulceration of the bladder, dysenteric and follicular ulceration of the rectum, and ulcers of the cervix may produce a localized low-grade inflammation of the neighboring cellular tissue which finally results in a contracting cicatrix and an atrophy of the cellular tissue. Freund² has described a particular form of chronic parametritis to which he has given the name of *diffuse atrophic parametritis*. According to him, it results from frequently repeated and difficult childbirth, in which much blood has been lost,

¹Ill, Edward, J.: "The Causes, Diagnosis, and Non-surgical Treatment of Pelvic Inflammation," Amer. Gynec. and Obstet. Jour., September, 1900.

²Freund, W. A.: "Das Bindegewebe in weibl. Becken und seine pathol. Veränderungen mit bes. Berücksichtigung der Parametritis chron. atrophicans und der Echinokokkus," Krankheit gyn. Klinik, Strassburg, 1885, S. 203-369.

profuse diarrhea, persistent masturbation, long-continued physical and mental strain, and malnutrition. In this condition there is a diminution in the elasticity and an atrophy of the pelvic cellular tissue and the internal genitalia. Changes in the pelvic nerves and ganglia are also said to occur. Schultze¹ has described a form of parametritis which he believes occurs especially in connection with pathologic antelexion. In this form, which he called *parametritis posterior*, the folds of Douglas are unusually short and inelastic. According to Schultze, the affection is caused by chronic constipation or by masturbation. Most gynecologists at the present time regard both the parametritis chronica diffusa of Freund and the parametritis posterior of Schultze as very rare affections. Küstner² found in a number of cases which answered very well to the description of parametritis posterior, that the lesion was intraperitoneal. It should be remembered that the pelvic connective tissue varies normally in different individuals, and that the rectum and the uterosacral folds in many women are sensitive to pressure through the vaginal vault. The conclusion, therefore, that an actual lesion of the cellular tissue is present because the uterosacral ligaments feel thicker than normal or are tender on pressure is not justifiable.

Symptoms.—The patient complains of the usual train of gynecologic symptoms—backache, dysmenorrhea, leukorrhea, etc.—depending in the individual case upon the part of the cellular tissue affected and the amount of dislocation of the pelvic organs which has been produced.

Diagnosis.—Scars in the vaginal vault extending from the cervix may be readily felt upon palpation. Contraction of the cellular tissue elsewhere is harder to distinguish positively from intraperitoneal adhesions. Needless to say, a positive diagnosis is sometimes impossible.

Treatment.—The purpose of treatment is to absorb the cellular exudate and to stretch cicatricial bands. To secure absorption there should be ordered a daily vaginal douche of hot normal saline solution, taken in the manner as already described (page 287), followed by rest in the recumbent posture for at least an hour, saline laxatives, and the use of tampons. The tampons should be introduced three times a week, soaked in glycerite of boroglycerin.

In an effort to stretch cicatricial bands the vagina should be systematically tamponed with the patient in that position which will most favor the restoration of the position of the uterus. Considerable pressure may be made with these tampons without danger. The smaller sizes should be used and the vaginal canal should be packed as firmly as is consistent with comfort.

Pelvic massage if ever useful is indicated in chronic uncomplicated cellulitis. It may be employed by the physician each time before he makes an application of tampons.

¹ Schultze, B. S.: "Ueber die pathologische Antelexion der Gebärmutter und die Parametritis posterior," Arch. f. Gynäk., 1875, Bd. viii, H. 1, S. 134.

² Küstner: "Die leitenden Gesichtspunkte für die operative Behandlung der chron. entzünd. Adnexa uteri und der Beckeneiterungen," Deutsche med. Wochenschr., 1895, Nr. 12, 13, S. 185, 206.

PELVIC HEMATOMA.

Etiology and Pathology.—Collections of blood confined to the cellular tissue of the pelvis are spoken of as hematomata. Most of them are obstetric in origin and will not be discussed here. The form of hematoma of special interest to the gynecologist is that which occurs in the parametrium, is not associated with pregnancy or parturition, and is commonly spoken of as hematoma of the broad ligament. It is an exceedingly rare affection. Martin¹ made the diagnosis of this condition but 3 times in 3000 gynecologic cases. He reports v. Rosthorn as not having had a single instance of hematoma in 3000 cases. Neither of the authors has ever seen a case. After operations which involve the base of the broad ligaments hematomata occasionally do occur, but aside from this form and that associated with labor or the puerperium, it is a very uncommon affection. Hirst reports a case occurring in an old woman, caused by a rupture of the pampiniform plexus. Although it is theoretically possible that the rupture of varicose veins in the broad ligament may occur and produce a broad ligament hematoma, its occurrence is extremely uncommon; a pelvic hematoma also may be caused rarely by the rupture of a tubal pregnancy between the layers of the broad ligament. This is the rarest of all the modes of termination of a tubal pregnancy and constitutes the subperitoneo-pelvic form of Dezeimeris. It was formerly considered common, but at that time it was confounded with tubal abortion and pelvic hemothecle.

Symptoms.—In the majority of cases, according to Martin (*loc. cit.*), hematoma of the broad ligament occurs in women over thirty years of age. The initial symptoms may come on suddenly and consist of intense pain and, if the hematoma is of considerable size, symptoms of internal hemorrhage. In many cases the pain is at first not very great, but gradually increases. Occasionally there is a feeling only of weight and a loss of support.

Diagnosis.—Examination shows a mass in the broad ligament varying in size from a pigeon's egg to a fetal head. The mass is intimately associated with the uterus. There are no signs of peritonitis. The effusion is more apt to be limited in extent in a hematoma than in a hemothecle, and it is confined to the side of the uterus rather than behind it, as is usually the case in pelvic hemothecle.

Prognosis.—A hematoma usually undergoes absorption. It may burst into the vagina, rectum, bladder, or the free peritoneal cavity. It may become infected and suppurate. Absorption of the blood is slow, but there is less tendency to bad after-results than in the case of hemothecle, because the peritoneum has not been involved and there are no intraperitoneal adhesions.

Treatment.—The patient should be kept quiet in bed. An ice-cap should be placed over the lower abdomen. After the hematoma is fully developed, hot douches and the local and the general depletory measures advised in chronic pelvic

¹Martin, A.: "Die Krankheiten des Beckenbindegewebes und des Beckenbauchfells," Handbuch der Krankheiten der weiblichen Adnexorgane, Berlin, 1906.

congestion on page 270 should be adopted. In those cases in which improvement does not follow, palliative measures should be discarded and the hematoma should be opened and drained by means of a vaginal incision.

PELVIC HEMATOCELE.

Etiology and Pathology.—A pelvic hematocele is formed by an effusion of blood into the peritoneal cavity, which subsequently becomes encapsulated. In the great majority of cases the condition results from tubal pregnancy and is fully discussed in the chapter upon ectopic pregnancy, Volume II. Other causes for pelvic hematocele rarely obtain. Thus, it may follow operation; it is sometimes produced by the rupture of adhesions or of one of the pelvic organs during pelvic examination. It has been ascribed to the reflux of menstrual blood into the peritoneal cavity in cases of gynatresia (this must be very rare, if, indeed, it ever occurs); hematocele has resulted also from the bursting of a hematoma of the broad ligament.

Symptoms.—The immediate symptoms are pain and the evidences of internal hemorrhage. These are more pronounced when the hemorrhage occurs suddenly and when the effusion of blood is considerable. The symptoms after encapsulation has occurred are those of low-grade peritonitis associated with the pressure which the mass produces upon the surrounding organs, more especially upon the bladder and rectum. Thus, there may be more or less constant pain in the lower abdomen, a slight elevation of temperature and pulse, painful and frequent micturition, and more or less difficulty or pain in securing a movement of the bowels. Patients will sometimes have a more or less constant desire to defecate. Pelvic examination in the early stage, when the hemorrhage has just occurred, may show fluid in the pelvic cavity, as indicated by an indefinite sense of fullness in Douglas' pouch. After encapsulation and the formation of adhesions have begun a pelvic mass will be found back of the uterus, which is, as a rule, displaced forward and perhaps to one side. These collections of partly coagulated blood will sometimes give a characteristic feel to the finger on rectal examination. The sensation imparted to the finger is like the sensation imparted by a thick jelly. The tumor is doughy and semisolid.

Diagnosis.—The history of extrauterine pregnancy or of tubal abortion will, in a large proportion of cases, indicate the condition. The pelvic mass lies in Douglas' pouch and pushes the uterus forward and upward in typical cases, and the characteristic jelly-like feeling, as already described, may be imparted to the fingers.

Prognosis.—Almost all cases require operation. If this is not done the patient continues to suffer and the mass is quite likely to become infected and suppurate. It is unquestionable that small intraperitoneal collections of blood are sometimes absorbed. There may, however, be recurrent hemorrhages and the mass may increase in size.

Treatment.—The treatment is almost entirely operative. In the past pelvic

hematoceles were treated expectantly, and the long-drawn-out invalidism and suffering which resulted from this plan is indicated by the literature upon this subject prior to the year 1882. If the hematocele is absorbed by expectant treatment, the tube often remains permanently affected and salpingectomy is required to free the patient of pain. The operative treatment of pelvic hematocele in our hands has been so satisfactory (mortality under 1 per cent.) that we would unhesitatingly advise it.

GONORRHEA.

General Peculiarities.—The initial symptoms of gonorrhea are apt to be less acute and, therefore, the disease is more insidious in the female than in the male. It is also more capable of harm and its ravages frequently lead to chronic invalidism or even to death. The frequency of gonorrhea in the female is difficult to estimate. There is a great variation among the different classes of society. Johnson¹ reports that in 1901 the Section on Hygiene and Sanitary Science of the American Medical Association sent the following query to many of the leading gynecologists in this country and in Europe: "What is the proportion of cases of pelvic inflammation coming under your care which are attributable to gonorrheal infection?" The general average of the proportions given was 40 per cent. Noeggerath² first drew attention to the frequency and the seriousness of the disease in women. He believed that eight out of every ten married men in New York city had had gonorrhea before their marriage and that a majority of them subsequently infected their wives. This is undoubtedly an exaggeration. Nevertheless, it is probably true that there is no single disease of the genital organs that produces half so much suffering, mutilation, and direct mortality as gonorrhea. Bumm estimates that one-third of the cases of sterility in women is due to the gonococcus. The number of instances of race suicide due to this disease, if it could be ascertained, says Johnson, would equal the number of lives lost from either pneumonia, tuberculosis, or typhoid fever, or maybe all of them combined.

The gonococcus is a peculiar organism. Extremely hard to grow upon culture-media and incapable of producing gonorrhea in animals, it is yet one of the most difficult organisms of which to rid the generative organs of women once they have been infected. The gonococcus has little power of penetration as compared with the streptococcus. Upon the cutaneous surface or the modified skin covering of the vagina or the vulva it has little influence. Within glandular structures, however, it produces a serious persistent inflammation which shows but little tendency to a spontaneous cure. Wertheim³ has shown that the gonococcus is not an organism which affects the mucous membranes solely. It occasionally invades and becomes

¹ Johnson, Jos. T.: "The Effects of Gonorrhea on the Female Generative Organs," Jour. Amer. Med. Assoc., March 11, 1905, p. 757.

² Noeggerath, Emil: "Die latente Gonorrhoe im weiblichen Geschlecht," Bonn, 1872.

³ Wertheim, E.: "Zur Frankfurter Gonorrhoe-Debatte," Centralbl. f. Gynäk., 1896, Nr. 48, S. 1209.

embedded in other tissues, and grows and produces a reaction there. Thus the organism may rarely be the cause of parametritis; it has also been found in the wall of the Fallopian tube at a considerable distance from the mucosa. Gonorrheal arthritis and gonorrheal endocarditis are further indications of the truth of Wertheim's assertion. A peculiarity of the transmission of gonorrhea is that infection from an old gleet discharge (morning drop), when there have been no acute symptoms, and of which perhaps the possessor is not aware, may produce in a second person a gonorrhea of the most violent sort. Again, married people infected with the gonococcus may become more or less immune to their own particular organism, so that the symptoms and signs of the disease may entirely subside. If these people live apart from one another for a considerable period, upon resuming sexual intercourse a violent gonorrhea may be set up in either though both have been virtuous during their separation. Or if the organism of a married couple is transferred to a third person and then again to one of the couple, it is capable of producing a violent attack.

Latent and Residual Gonorrhea.—Chronic gonorrhea may exist in an individual without producing noticeable symptoms. Under such circumstances the host may be entirely unaware of its existence until, after some unusual irritation of the sexual organs, it reappears in an acute or in a subacute form. This fact was first noted by Noeggerath, who spoke of it as the latency of gonorrhea. Luther¹ correctly states that it would be better to say the latency of the gonococcus. Fritsch² speaks of gonorrhea without symptoms. Residual gonorrhea is a chronic affection, spoken of by Saenger,³ which depends no longer upon the presence and the activity of the gonococcus, but upon the tissue changes produced by the organism at a previous time.

Symptoms.—Gonorrhea in the female does not have the violent initiative course that it has in the male. Indeed, in an uncleanly woman or in one of sluggish sensibilities the disease may exist for some time before she is aware of its presence. This is because the urethra in the female, being short and not surrounded by erectile tissue as in the male, an inflammation of the mucous membrane is not so painful and the difficulty in urination is not so marked. Furthermore, in the female gonorrhea is not necessarily first localized in the urethra. It may occur primarily in the cervix or in the vulvovaginal glands; in either situation it is less apt to produce acute initial symptoms than in the urethra. Occasionally, either because the infection is unusually virulent or the affected parts are unusually susceptible, gonorrhea does produce violent initial symptoms. In such cases, in addition to a violent local reaction in the affected parts (see Urethritis, page 457; Vulvitis, page 247; Endocervicitis, page 261), there may be some slight constitutional disturbance. The urethra is more often the seat of an initial attack of gonorrhea than the glands of

¹ Luther: Quoted from F. Staehler: "Neuere Arbeiten über die Pathologie und Therapie der Gonorrhea des Weibes," Monatschr. f. Geburtsh. u. Gynäk., Bd. xvii, H. 1, S. 71.

² Fritsch, Heinrich: "Die Krankheiten der Frauen," 2 Aufl., S. 613, Leipzig, 1905.

³ Saenger, M.: Quoted from Staehler (*loc. cit.*).

Bartholin or the cervix. For this reason the very first symptoms of gonococcus infection in woman are often vesical. The patient complains of frequent and painful urination, has a burning pain about the external urinary meatus, and observes a leukorrheal discharge. It is a great mistake at this time to make a vaginal examination or to introduce a speculum unless there is a leukorrheal discharge from the vagina. If the vulva is carefully cleansed by pledgets of cotton, and the lips of the smaller labia are separated so that the vaginal introitus is exposed to view, any vaginal discharge can be detected. In case of doubt it is better to accept the risk of leaving a cervical nidus of infection untreated for a short time, than to run the chance of infecting a healthy cervix by any sort of an examination or treatment inside the vaginal orifice. In the subacute or in the chronic stage of gonorrhea the infection is frequently localized in the glands of Skene, the glands of Bartholin, and the cervix. At this time there very often appear at the urinary meatus (Skene's tubules) and about the orifices of the ducts of the vulvovaginal (Bartholin's) glands small areas which resemble flea-bites. They are known as the macula gonorrhoeica or gonorrheal macules. They may be found also in the posterior vaginal fornix, when the cervix is the seat of gonorrhea and the posterior vaginal fornix is constantly bathed with gonorrheal pus. In old cases of gonorrhea all gross evidences of the disease may disappear from the external genitalia and from the cervix, even though the disease is still present and capable of being transmitted to another person. The discharge from the glands of Skene, from Bartholin's glands, and from the cervix, even though it appears as a small amount of glairy mucus, often will show the gonococcus. Under such circumstances it may be necessary in the search for the gonococcus to examine smears taken at different intervals between the menstrual periods; occasionally the organism will be found in the cervical discharge only after a menstrual period.

From what has been said it can easily be seen that in the chronic latent forms of gonorrhea a woman, by careful douching, etc., can remove all of the gross evidences of the disease. It should be made a practice to instruct patients not to use a douche before coming for examination. Unless instructed in this particular most women, from motives of cleanliness, will douche themselves immediately before consulting a physician. The other parts affected by gonorrhea are the endometrium, the Fallopian tubes, the pelvic peritoneum, and the vagina. The disease is considered under the sections which deal with these organs.

Diagnosis.—Brose and Schiller¹ believe that the recognition of the gonococcus in smears is not necessary for the diagnosis of gonorrhea. The coincident infection of the urethra, Bartholin's glands, and the cervix, and especially the presence of gonorrheal macules at either of these situations, are sufficiently significant to warrant a diagnosis. Neisser² and his pupils insist upon the recognition of the gono-

¹Brose, P., u. Schiller, H.: "Zur Diagnose der weiblichen Gonorrhoe," Berlin. klin. Wochenschr., 1898, Nr. 26, S. 580; Nr. 27, S. 600; Nr. 28, S. 625; Nr. 29, S. 643.

²Neisser, A.: "Forensische Gonorrhoefragen," Aerzte Sachverst. Zeitg., 1895, Nr. 12.

coccus, and this would be requisite to establish the diagnosis if it were desired for forensic purposes.

The Technic of the Preparation and the Examination of Smears for the Gonococcus.—In the preparation of smears for the detection of the gonococcus it will be necessary to avoid the transference of infectious matter from one point to another. For this reason the platinum wire, or the applicator, or whatever is used to transfer the suspected discharge to a glass slide, should be carefully wiped clean and sterilized in an alcohol flame after each smear is made. The glass slides should be well cleaned before using and each one should be labeled immediately after. The smears must be made very thin. Glass slides are preferable to cover glasses. If the smears are contaminated with a lubricant of any kind—vaselin, glycerin, etc.—they will not stain well; consequently in procuring them the physician's hands should be free from these substances. It is not often requisite to obtain smears from the vulva or the vagina. In the case of actual vulvitis or vaginitis in young children it may be necessary to do so. Under such circumstances it would be difficult to secure the discharge, as is done in the adult, from the cervix, the urethra, and the vulvovaginal glands, and in these cases the platinum loop may be scraped along the vulvar surface or passed directly into the vagina. In the adult it is unnecessary to take smears from the vulva or the vagina, for gonorrhea seldom exists alone in either place.

At least three hours after the passage of urine or the use of a vulvar or vaginal douche the patient should be placed in the dorsal position upon an examining table and the external genitalia exposed to view. The entire vulva should be gently wiped free from discharge. The forefinger of the left hand is introduced into the vagina and the palmar surface turned upward. The contents of the urethra are now expressed by drawing forward the finger, which is pressed steadily against the floor of the urethra. The end of a platinum wire or an applicator is used to transfer a portion of the muco-pus to a glass slide which is labeled "urethra." In chronic cases it may be necessary to strip the urethra several times in order to secure an appreciable quantity of discharge. In such cases, too, the excretion from Skene's tubules is more apt to contain the gonococcus than that from the urethra itself. The orifices of Skene's tubules are about 2 mm. within the urinary meatus on the floor of the urethra; they can readily be seen in the parous woman in whom there is some eversion of the meatus; in nullipara the lips of the meatus must be slightly everted to expose them. To collect the discharge from these ducts themselves, the end of a straight platinum wire should be passed directly into them, or they may be stripped in the manner already described for the urethra.

Practically it makes no particular difference whether the gonococcus is found in the urethra or in Skene's tubules, and the discharge from the tubules may be collected with that from the urethra. In chronic cases, however, the urethra may be entirely free while the tubules are the seat of a chronic infection. Even a small amount of thin milky discharge may contain large numbers of the gonococcus.

The secretion of the vulvovaginal glands should now be secured by gently com-

pressing the glands first on one side and then on the other between the thumb and forefinger. In doing this the forefinger is introduced just inside the vaginal orifice. A smear may be also taken by introducing a straight platinum wire directly into the duct of the gland. Smears from the vulvovaginal glands should be labeled "vulvovaginal gland," "right" or "left," as the case may be.

Smears from the cervix are taken by carefully exposing the part by means of a bivalve speculum. The portio and vaginal cervix are thoroughly cleansed of discharge, and the platinum wire or the applicator is introduced into the cervical canal, care being taken not to overstep the bounds of the internal os. The loop of the platinum wire or the applicator should be made to engage the folds of the cervical mucosa at the circumference of the cervical canal. By doing this one is more apt to find lurking gonococci. The glass slide should be labeled "cervix." The slides should be fixed and stained as described on page 49. An oil immersion lens will be required to recognize the gonococcus. As a rule, if the discharge is purulent and the smears show myriads of bacteria, the gonococcus will not be found. There are a number of cocci that slightly resemble the gonococcus. To the beginner this may occasion some confusion. When the gonococcus is present it will usually be recognized from its form, or its position within the epithelial or the pus cells. It is of service to one unused to bacteriologic work to have a type specimen of the gonococcus at hand and to compare with it the specimen for diagnosis.

Prognosis.—If the disease is carefully managed during the initial stages, and if reinfection can be prevented, the prognosis is favorable. In old cases, where the disease has persisted, either as the result of insufficient or of careless treatment or as the result of repeated infection, the prognosis is doubtful. It depends, of course, upon the organs involved. Gonorrhea is much harder to cure when once it has passed into the uterine cavity or into the Fallopian tubes. Gonorrheal salpingitis or pyosalpinx usually requires operation. Even after both tubes are removed in case of bilateral pyosalpinx, a gonococcal infection may persist in the endometrium, cervix, vagina, vulvovaginal and Skene's glands. It is not apt to do so, however, and most of the cases recover entirely after a radical operation if they receive medical attention.

Prophylaxis.—Very much has been written upon this subject. Some of the plans suggested to prevent the spread of gonorrheal infection have signally failed and others appear at once to be impracticable. The segregation of prostitutes and the examination of them at regular intervals has failed in its purpose. This is partly because a woman with chronic gonorrhea can often, by cleansing douches, etc., conceal it from a physician, unless a painstaking examination is made and the patient observed during a length of time and under the certain conditions which have been discussed. The same is equally true of the male. It has been proposed that marriage should not be allowed until a careful examination of the male, by a physician, shows him to be perfectly sound. Such a plan at present, in this country, is impracticable to a great extent. Both sexes, however, should know of

the seriousness of the disease and should be made to feel the responsibility of transmitting it to others. If the truth about gonorrhea were commonly known, few persons who have had the disease would enter the bonds of matrimony or indulge in sexual intercourse without seeking professional advice. A knowledge of the suffering and the dangers incident to gonorrhea would also go far toward discouraging intercourse previous to marriage. Moral training, if extensively adopted and obeyed, would do more to eradicate the infection than any other plan.

Treatment of the Acute Initial Stage.—If possible, the patient should be put to bed. When this is impracticable, muscular exertion should be reduced to a minimum. The diet should be as simple as the patient finds it expedient to take. A skim-milk diet, exclusively, is to be preferred. If such a selection is objectionable because of the attention it might excite, a diet which is free from fat, spices, and condiments will answer. As little tea, coffee, and pastry as possible should be taken. Alcoholic and acidulous drinks should be given up.

Congestion of the genitalia, nervousness, and frequent and painful urination may be relieved by the following formula:

R. Tr. verat. virid. gtt. viij
 Potas. bromid.
 Sod. bicarb. āā ℥viiij
 Liq. potas. citrat. f℥viiij
 M. and S.—f℥ss in water every two hours. (White and Martin.)

Nothing more should be done in the very earliest stage. The patient should be especially cautioned against the use of a vaginal douche. A gauze and cotton pad should be worn over the vulva in order to catch the discharge. If an actual vulvitis exists, the patient must almost necessarily go to bed and applications to the vulva of hot compresses, as directed on page 248, must be made. After the acuteness of the condition has been ameliorated, and the discharge has a markedly purulent appearance, urethral injections may be used. The patient must never be allowed to try them for herself and, if the physician doubts his ability to carry out the directions given below, it will be far better to omit injections altogether. When injections are begun, a capsule should be ordered, consisting of oil of sandal and balsam of copaiba, each $\mathfrak{m}\mathfrak{v}$. In skilled hands the urethra may be injected with a solution of argyrol and alum, beginning with a 5 per cent. solution of argyrol containing one-fourth of a grain of powdered burnt alum to an ounce. This may be increased finally to argyrol 20 per cent. and alum gr. iv to an ounce. The injection is carried out as follows: The patient is placed in the dorsal position immediately after evacuating the bladder. The external meatus is carefully cleansed of discharge and *fifteen* drops of the argyrol and alum solution are injected into the urethra. For the purpose of injection a sterilized glass medicine-dropper will be entirely satisfactory. The point should be gently inserted for a quarter inch within the meatus and the lips of the meatus should be gently closed against the pipet while the solution is pressed into the canal. This procedure may be repeated daily until the symptoms are quiescent and the discharge small in amount and muco-purulent in type.

An injection may now be used of sulphate of zinc and powdered burnt alum, of each grs. xv, with an ounce of the fluidextract of hydrastis, in four ounces of water. Later on a more astringent injection may be used to dry up the last remnant of discharge. A favorite one is:

R. Ac. tannic.
Zinci acetat..... āā gr. xx.
Aquæ destil..... f℥iv.
M.

When gonorrhea of the urethra has become chronic, a careful examination will show, almost invariably, that the infection is localized in the glands of Skene. The infected tubules should be treated by the direct application of ichthyol, which should be injected into them through a blunt hypodermic needle. Chronic urethritis of the posterior part of the urethra or neck of the bladder should be referred to a specialist. Meddlesome treatment will often do more harm than good, while well-directed local applications will hasten a cure. It requires considerable experience, however, with such work to do it properly.

For the details of treatment of vulvitis, vaginitis, endocervicitis, endometritis, salpingitis, peritonitis, etc., caused by the gonococcus, see the appropriate chapters.

DYSPAREUNIA.

Etiology.—There are a number of conditions of the pelvic organs which render coitus painful to the woman,—a hyperesthetic state of the nerves supplying the introitus vaginæ, pelvic inflammatory disease, prolapsus of the ovary, inflammation of the vulva and of the vagina, urethral caruncle, painful scar of the perineum or posterior vaginal wall,—any of these conditions may produce dyspareunia. Occasionally the initial marital intercourse produces so much pain, either because the parts are rigid or the effort is violent, that a psychic element becomes manifest. The woman, remembering the first experience, will approach a repetition of the act with considerable dread, and, as a consequence, painful contractions of the levator muscles may occur which render cohabitation very painful or even impossible. The chief element in many cases is a hyperesthesia of the genitalia associated with a neurotic temperament.

Treatment.—Simple cases of this sort may be treated by gradual dilatation of the vaginal orifice by means of a narrow-bladed bivalve speculum, which is introduced closed and then slowly opened. Treatments of this sort, followed by the introduction of vaginal tampons three or four times a week and the positive assurance that there is nothing abnormal, will usually result in overcoming the difficulty. The application to the vulva of a compress of cotton moistened in a solution of cocain (4 per cent.) previous to copulation, and the use of petroleum jelly, is sometimes advisable. A course of bromids in conjunction with general measures to improve the tone of the nervous system is often indicated in neurotic cases.

In the severer forms of dyspareunia of this type, which are called vaginismus, treatment can only be carried out under anesthesia. (See Vaginismus, page 342.)

When dyspareunia is due to local disease, the treatment resolves itself into that which is indicated for the particular affection.

THE CARE OF PATIENTS AFTER OPERATION WHEN THEY HAVE PASSED FROM THE HANDS OF THE SURGEON.

An operation is often regarded as a failure, so far as a relief of symptoms is concerned, because the patient is not treated properly after her immediate convalescence. After she passes from the hands of her surgeon to her family physician, it should not be imagined that there is no further need, in her case, for medical attention and advice. The surgeon has truly removed the principal or the sole cause of her disability, but there may remain local changes, in proximity to the operative field, or general ones, the result of her illness, which ought to be given careful attention. After a perfectly normal convalescence, in even the simplest intraperitoneal operation, there is very apt to be some inflammatory induration of the parts directly in the operative field. Thus, after a simple ventrosuspension of the uterus, bimanual palpation, at the end of three weeks from the day of operation, will disclose induration beneath the abdominal incision and a feeling as if the uterus was slightly enlarged. This is to be accounted for by the processes of tissue repair, which have been actively going on and which are still manifested by hypertrophy of the parts or by a plastic exudate.

This traumatic hypertrophy and infiltration is still more noticeable in cases where the appendages have been removed, especially if the broad ligaments have been ligated *en masse*. A moment's reflection will show that in such cases there must be a considerable amount of tissue, in or beyond the bite of the ligature, which at first is necessarily either nearly or entirely deprived of its vascular supply. In the course of time the ligatures are absorbed and the parts become revascularized. All of this requires time, and for a while the parts are hypertrophied, infiltrated with leukocytes, and surrounded by plastic lymph.

As the patient customarily leaves the immediate charge of the surgeon before the operative areas have had full time to undergo the contraction and cicatrization which must occur before healing is perfect, it is necessary that she be placed under such hygienic regulations that the restoration of the affected parts to the normal will be furthered and not delayed. To this end, any strain of the parts by violent exercise or by heavy work should be avoided; a certain graduated amount of exercise should be taken, but it should be so regulated that there is little chance for pelvic congestion. Free evacuation of the bowels and active urinary excretion favor the same end; on the contrary, heavy lifting, constant sitting, constipation, and sluggish kidneys have a tendency to defeat it. Sexual excitation and intercourse should be avoided for eight or ten weeks following any gynecologic operation. There is a great advantage in a highly nutritious and generous diet at this time. The patient has usually lost flesh and strength. Because of her enforced rest the

appetite is frequently poor, and even though before her confinement to bed intestinal torpor has been unknown, it is very apt to follow. There is some use, therefore, in prescribing a stomachic and tonic combined, and a mild laxative. We know of no drugs which serve the purpose better than *nux vomica* (gtts. xv of the tincture) and bicarbonate of soda (gr. x), given half an hour before meals, and the daily exhibition of a pill of

Cascarin	gr. $\frac{1}{4}$
Aloin	gr. $\frac{1}{4}$
Podophyllin	gr. $\frac{1}{4}$
Ext. belladonna	gr. $\frac{1}{8}$
Strychnin sulphate	gr. $\frac{1}{8}$
Gingerin	gr. $\frac{1}{8}$

It is not advisable to employ local measures unless the patient complains of pain in the lower abdomen and a pelvic examination reveals tenderness and induration. When fever is present in such a case the patient should be put to bed and treated by means of hot vaginal douches, etc., as noted under the treatment of gonorrheal peritonitis, page 287.

In the absence of fever, the patient should be allowed to take daily exercise in the open air or even to do light work; at the same time she should have that form of local treatment which depletes the pelvic circulation. This has already been described on page 223.

The relation of operations upon women to the neuroses will be more fully considered on page 314. In this connection it is of importance to call attention to the necessity for special care of the woman's nervous system after operation. In a woman who has a normal nervous system and who has had an operation which does not entail special or long-continued suffering, as a rule, there are no nervous manifestations following the operation. On the other hand, in women of neurotic temperament, and more especially in women having an unstable nervous system from congenital or developmental defects, there often arise various nervous manifestations. The woman may be merely nervous, or her mental poise may be lost, or she may develop definite neurasthenia, which under the circumstances may be called traumatic neurasthenia, and is akin to the so-called "railway spine." Whenever, following operation, it is evident that the nervous system is not normal, this condition must engage the serious attention of the physician. At this time it is comparatively simple, by means of a modified or complete rest cure, by the observance of hygienic principles, and by tonic treatment and special attention to nutrition, to cure the particular nervous trouble which may have developed. For a consideration of this form of treatment the reader is referred to standard treatises upon nervous diseases.

Much can be done in most of these cases in which the mental poise is disturbed by judicious advice and encouragement. Many women, under such circumstances, require the support which they derive from professional advice and encouragement. If these very evident facts are considered by the family physician, and if women whose nervous systems have been upset as a result of operation are

treated along the line suggested, there will be far less complaint of nervous troubles following operation.

TRAUMATIC NEURASTHENIA.

The condition of neurasthenia may follow operation in a woman whose nervous system was previously normal, but this is rare. Traumatic neurasthenia usually develops in women who have had defective nervous organizations due either to congenital or to developmental defects. In such cases usually the mental poise is easily disturbed and the nervous mechanism, as a whole, is in a state of unstable equilibrium. In many of these women neurasthenia existed before operation and was merely aggravated by it. The physician and the surgeon should take these facts into consideration in deciding for or against an operation upon women of this class. In all such women it is desirable by means of judicious preparatory treatment to put the nervous system in the best possible condition before operation, and by means of judicious care, hygienic management, and, if necessary, a partial or a strict rest cure, to restore it as nearly to the normal as feasible after operation. The patient should be advised against a resumption of her usual duties at an early date. After-treatment should be prolonged; whenever the means of the patient permit, before she is allowed to resume her usual duties and responsibilities, she should be sent away for rest and recuperation, or for the diversions incident to travel, by which her nervous tone may be restored. Traumatic neurasthenia is quite different from hysteria which follows operation. The latter is often made worse by the extra attention, or even coddling, which is so necessary for the neurasthenic.

THE TREATMENT OF YOUNG WOMEN HAVING PELVIC SYMPTOMS.

A young woman who has a neurotic temperament or a congenital or an acquired defect of the nervous system may manifest symptoms referable to the pelvis. She may suffer from backache, pains in the groins, and painful menstruation. As a result, she may acquire the belief that she is suffering from pelvic disease, even though her pelvic organs are entirely normal. Furthermore a young woman with a normal or with a defective nervous organization may develop *actual disease* of the pelvic organs, such as ovarian tumor, tuberculosis of the uterine appendages, or displacement of the uterus (more especially retrodisplacement). Such a patient naturally has the symptoms referable to these diseases. This brings up the question as to what shall be the attitude of the practitioner toward the young and unmarried woman who presents pelvic symptoms. The fact that a woman is young and unmarried is no reason why she should continue to suffer from pelvic disease when this can be cured by treatment either medical or operative. On the other hand, because of the modesty natural to a young woman, it is highly important that she should not be subjected to pelvic examination or to local treatment unless there be definite local disease. Another factor enters into the problem. Because of the small size of the vagina in the virgin and because of the mental disturbance which a pel-

vic examination usually causes, it is difficult, if not impossible, to make a diagnosis in the majority of cases without administering a general anesthetic. For all these reasons, when a young unmarried woman has symptoms which may be due to pelvic disease, it is advisable to have the patient examined under general anesthesia, by an expert gynecologist, in order that a positive diagnosis may be made. If it be found that the pelvic symptoms are due to a disease of the nervous system, the patient and her friends can be assured positively and authoritatively that she has no pelvic disease; thus, she can be spared the shock to her modesty and the annoyance and the possibly bad consequences of ill-directed local treatment.

In the past the mistake has been made too often of treating young women locally for "inflammation of the ovaries," or "flexion of the uterus," when as a matter of fact both the uterus and the ovaries were normal and the local symptoms were due to a defective nervous organization, to neurasthenia, to hysteria, or to neuralgia. As a result of this maltreatment much harm was done and many of these women became confirmed nervous invalids with psychoses or with fixed ideas concerning their sexual organs. In the light of our present knowledge, such treatment is reprehensible.

If, on the other hand, definite disease of the pelvic organs is present, a diagnosis can be established and the proper treatment can be advised. The latter almost invariably will be operative in character; in other words, virgins almost never have pelvic disease which is benefited by local treatment. Virgins do not acquire gonorrhea except by a rare accident. Nor do they have vaginitis from other causes, for the vagina is not subject to traumatism or to accidental infection. Malposition of the uterus in virgins should not, as a rule, be treated by local measures, as such treatment almost never results in a cure. For the other gross lesions of the pelvic organs which develop in virgins, local treatment is of little or no benefit. Therefore, when virgins have pelvic disease, almost without exception operative treatment is demanded. In other words the treatment of young unmarried women who have pelvic symptoms consists of hygienic measures, which have the purpose of improving the general health and vigor, medical measures addressed to the relief of nervous diseases which may be present, or operative measures demanded by gross lesions of the pelvic organs. Local applications or manipulations have almost no field in the treatment of pelvic disease in young women.

THE NEUROSES IN THEIR RELATION TO GYNECOLOGY.

A correct understanding of the relation between the neuroses and diseases of the sexual organs is of great importance in guiding the practitioner. The lack of exact knowledge upon this subject in the past has led to much unnecessary and harmful local treatment and to many unnecessary and mutilating operations. In order that the proper treatment may be instituted, it is essential that the purely neurologic diseases are not confounded with those purely gynecologic, and also that their true relation, whether accidental or whether bearing the relation of cause

and effect, is recognized. In the past gynecologists and neurologists have held divergent views concerning the relation between the neuroses and the gynecologic diseases; at the present time they are for the most part in accord, and if any differences exist it is with reference to the plan of treatment, more especially as to whether the purely gynecologic or the purely neurologic treatment shall be employed first in those cases in which both are indicated. The association between neurologic and gynecologic diseases as seen in practice is observed in three groups of cases:

- (A) Women suffering from neuroses with pelvic symptoms in whom the pelvic organs are anatomically normal.
- (B) Women suffering from neuroses, congenital or acquired, in whom the pelvic organs are diseased.
- (C) Women suffering from reflex neuroses due to disease of the pelvic organs.

(A) Women Suffering from Neuroses with Pelvic Symptoms in whom the Pelvic Organs are Anatomically Normal.—This group of cases may well be subdivided into:

(1) Neuroses of congenital or developmental origin occurring in neuropathic individuals with defective nervous organizations due to heredity or to defective development, or to both. This class includes: hysteria (hysteria major), with such symptoms as hemianesthesia, hysteric convulsions, hystero-epilepsy, and a reversal of the fields of vision; epilepsy; the migraines; the psychoses, including such conditions as mild mania at the menstrual periods, fixed ideas connected with the sexual organs, masturbation due to degeneracy or to delusional insanity, and the so-called "cranks."

(2) Acquired neuroses, including neurasthenia, hysteria in its milder and more common form (the hysteroid condition), and the neuralgias.

These conditions are all purely neurologic and are in no sense gynecologic. They are more or less modified by the functions of the sexual organs and often become exaggerated at or about the menstrual periods.

Treatment.—When the sexual organs are anatomically normal, local treatment or operation is positively contraindicated; local treatment aggravates the nervous condition, and an operation becomes a mutilation when it involves the removal of healthy organs. Gynecologists in the past were guilty of removing normal ovaries of many such women in the mistaken belief that such an operation *might* cure the neurosis which was present. Such practice belongs to the past and would be reprehensible at the present time. Even pelvic congestion which does not, as a rule, produce gross anatomic changes and which might call for local treatment, is far better dealt with by general measures addressed to the circulation. (For a full consideration of the management of this group of cases the reader is referred to standard works upon Diseases of the Nervous System.) Such pelvic symptoms as dysmenorrhea, irregular or scanty menstruation, irritability of the bladder, and backache, are often complained of in neurologic cases. Under such circumstances,

when the pelvic organs are normal the symptoms depend upon a derangement of the nervous system, a poor state of the general health, or a disturbance in the general circulation. When there is doubt as to the existence of pelvic lesions in women who are the subjects of neuroses, pelvic examination should be made under anesthesia by an experienced gynecologist. If no lesion of importance is discovered, the patient should be assured positively that the pelvic organs are normal and she should be referred to a physician or to a neurologist for neurologic treatment.

(B) **Women Suffering from Neuroses, Congenital or Acquired, in whom the Pelvic Organs are Diseased.**—A woman belonging to this class usually suffers more than one with a normal nervous system, and therefore she needs local treatment or an operation more than a woman with a normal nervous organization. On the other hand, such women run an increased risk of developing traumatic neurasthenia after operation. It is in this group of cases that errors of practice are most apt to be committed, through a mistaken belief that pelvic lesions of slight or of minor importance are giving rise to the nervous symptoms present, but which in fact are quite independent of the condition of the pelvic organs. Slight deviations from the normal in the form and position of the uterus, slight lacerations of the cervix, and slight enlargements of the ovaries due to the presence of unruptured Graafian follicles, do not require treatment in this group of cases any more than in women having a normal nervous system. When serious pelvic lesions are present, such as marked lacerations of the perineum or of the cervix, displacements of the uterus, inflammatory affections of the uterine appendages, tumors of the ovary or uterus, ectopic pregnancy, etc., the usual treatment for the care of such lesions should be carried out irrespective of the complicating congenital or acquired neurosis. It is desirable, when practicable, to use preliminary treatment so as to put the nervous system in as good condition as possible before resorting to operation. The mistake should not be made, upon the one hand, of magnifying the importance of trifling pelvic lesions in neurotic, neurasthenic, or hysteric women, or, on the other hand, of overlooking or disregarding the presence of serious disease of the sexual organs in women belonging to this group. The first error is most apt to be made by the family physician and by the general surgeon who is not well trained in gynecology; the second is made not infrequently by neurologists. Local treatment or operation is even more necessary in these women than in those having a normal nervous organization, as their sufferings are greater; but a proper prognosis should always be given to the patient, and her friends should be told that a cure of the pelvic disease will relieve the symptoms due to the local disease only, and will not cure the associated neurosis. As already stated, in a previous section, in this group of cases especially it is important to prolong the confinement to bed after operation. A partial or a complete rest cure will often be required in order to get rid of the associated neurosis and to restore the woman as nearly as possible to sound health before she is permitted to take up her usual duties and to bear the burden of her usual responsibilities. In advising operation in this group of cases, it should not be forgotten that there is a definite risk of causing traumatic neurasthenia; but this is a risk which must be taken when operation is necessary.

Curative treatment or operation upon a woman belonging to this group reduces a complicated case of nervous disease and pelvic disease to a simpler one of nervous disease alone.

(C) **Women Suffering from Reflex Neuroses due to Disease of the Pelvic Organs.**—Disease of the pelvic organs at times produces nervous disturbances in adjacent or in remote parts of the body. These disturbances are usually spoken of as reflex neuroses. There is no doubt that the influence of disease of the pelvic organs in the production of reflex disturbances in other organs was much exaggerated in the past. The neurologist points out the fact that with increasing knowledge concerning the nature of the functional nervous diseases, the field of the reflex neuroses has constantly become narrower. It is nevertheless true that disease of the pelvic organs does cause disturbances, neurotic in character, in other parts of the body. Disturbances of digestion, the so-called nervous indigestion, is very commonly associated with laceration of the cervix, retrodisplacement of the uterus, and degenerative change in the ovaries. Vertical headache is another reflex symptom which is frequently associated with disease of the pelvic organs. The existence of nervousness, backache, irritability of the bladder, and of other conditions may often be explained by an impairment of the general health and a loss of nerve tone, and need not be considered as reflex. On the other hand, there can be little doubt that these conditions are often reflex symptoms of pelvic disease. A woman who has a normal nervous system is much less apt to suffer from reflex symptoms than one who has congenital or acquired defects in her nervous organization. In other words, the one having an unstable nervous organization manifests greater reaction or exhibits more marked and more diverse symptoms than the one having a nervous system of a normal type. Reflex nervous disorders due to pelvic disease are quite analogous to similar disorders due to disease in other parts of the body, such as reflex symptoms from eye-strain, reflex symptoms due to displacement of the kidney, to enteroptosis, etc. The treatment of a reflex neurosis due to pelvic lesions consists in the cure of the causative lesion.

INSANITY IN ITS RELATIONS TO GYNECOLOGY.

Insanity is a disease of the nervous system. It is usually entirely independent of disease of the sexual organs. It may be complicated by disease of the sexual organs; or the latter, by its influence upon the general health, may favor the development of insanity, more especially in neuropathic women. When insane women present symptoms of disease of the sexual organs, it is advisable to have them examined by an expert gynecologist, so that a correct diagnosis of the condition of these organs may be made. Insane women having normal sexual organs are in no sense gynecologic cases and should receive treatment addressed to the mental disease alone. On the other hand, an insane woman who has disease of the sexual organs which injures her physical well-being, and one having a disease which threatens life, should receive the same treatment that would be indicated if insanity did not exist as a complication.

When the history indicates that the disease of the sexual organs has antedated the insanity and has undermined the health of the patient, and particularly the stability of the nervous system, gynecologic treatment is much more strongly indicated than in the class of cases already considered. In such cases even more than in the previous class there is reason to anticipate that the cure of the pelvic disease may exert a favorable influence upon the mental condition and may promote the recovery of the patient's sanity.

Insanity is one of the least common post-operative complications and it occurs after operations upon the sexual organs with about the same relative frequency as it does after operations upon other parts of the body. It is as frequent in the male as in the female. The usual type of alienation which develops after operation is that which is known as confusional insanity. Neuropathic individuals and those who have undergone great physical or mental stress before operation are the ones in which insanity is most apt to develop; especially if after the operation annoying and persistent painful symptoms make their appearance; such, for example, as infection of the bladder, leading to frequent and painful urination, and infection elsewhere leading to the necessity for dressings, with long-continued pain and annoyance due to them. In certain cases there is no doubt that the insanity is toxic in its nature and due to infection, but in most cases it appears to be due to a disturbance of the mental equilibrium, brought about by the stress and strain of the operative experience superadded to trials, grief, or mental excitement antedating operation. Trifling operations are as apt to be followed by insanity as those of a graver type. In the authors' experience insanity has usually followed plastic operations and almost never has complicated hysterectomy or ovariectomy. Confusional insanity arising after operation in a woman who previous to the operation had a normal or a fairly normal mind, usually ends in recovery in six weeks or less. In the authors' experience (comprising about twenty cases) one was fatal; the others ended in prompt recovery. These general principles may be regarded as a summary of the present views of both alienists and gynecologists concerning the relation of insanity to gynecology.

Those readers who are specially interested in the relation of insanity to gynecology are referred to standard treatises upon insanity. During the past fifteen years much has been written upon the subject, more especially by Rohe,¹ Picqué,² Bucke,³ Hobbs,⁴ Hall,⁵ Manton,⁶ and Broun.⁷

¹ Rohé, George H.: "The Relations of Pelvic Disease and Psychical Disturbances in Women," *Amer. Jour. Obstet.*, 1892, vol. ii, p. 694.

² Picqué, Lucien, et Dagonet, Jules: "Chirurgie des Alienes," Paris, 1901, 1903.

³ Bucke, Richard M.: Two hundred operative cases, insane women; *Proceedings of the Medico-Psychological Association*, 1900, p. 99.

⁴ Hobbs, A. J.: "The Relation of Insanity to Pelvic Diseases and other Lesions," *Amer. Jour. Obstet.*, January, 1900, p. 1.

⁵ Hall, Ernest: "The Surgical Treatment of Insanity," *The Canadian Practitioner*, April, 1898. "Pelvic Disease in the Female Insane," *Canada Lancet*, July, 1899, vol. xxxi.

⁶ Manton, Walter P.: "The Relations of Visceral Disorders to the Delusions of the Insane," *Amer. Jour. Obstet.*, New York, 1896, vol. xxxiv, No. 6, p. 806.

⁷ Broun, Leroy A.: Preliminary Report of the Gynecological Surgery in the Manhattan State Hospital, West; *Trans. Amer. Medico-Psychological Assoc.*, 1905.

Broun sums up the present attitude of both gynecologists and alienists in his contribution to the subject, which is based upon his experience with insane women in the Manhattan Hospital, West. His views and experience are quite in accord with the summary already given. He regards the following facts as well established:

"1st. If the operation when needed has been properly done and the patient is not mutilated by an uncalled-for castration, the mental condition is never aggravated by such a procedure. This, as stated, has been the experience of Manton, who has been operating for over twenty years; also that of Picqu , whose operations have extended over a period of twelve years; and of myself (Broun), in the entire range of my surgical work among the insane.

"2d. There exist among the patients confined in the various insane asylums many pathologic conditions which can and do give rise to symptoms detrimental to the patient's physical well-being and mental recovery. Those with such conditions have a right to be given relief irrespective of their mental state.

"3d. Under the stimulus of the improved somatic state resulting from surgical relief some of the patients show greater mental advancement under the moral and therapeutic care than were shown before such relief was given. At times this improved mental state continues to one of recovery.

"The primary object of surgical operations upon the insane should be to improve the physical status of the patient, with one end only in view, that of relieving them of physical suffering and nervous disturbances.

"If, as a result of this relief, they are mentally improved it is a sequel not primarily sought, yet welcomed."

Our present knowledge of this subject clearly indicates that an insane woman who presents pelvic symptoms should be submitted to an expert gynecologist for an exact diagnosis of the condition of her pelvic organs. When called for, and this is frequently the case, the examination should be made under the influence of an anesthetic. If the sexual organs are normal, treatment addressed to them is contraindicated. The removal of normal ovaries in women who are insane is a practice which has been advocated by Rohe and others, but it is condemned by the combined judgment of the profession. On the other hand, if disease of the pelvic organs is found which is injuring the general health, or threatening the life of the patient, the treatment, whether medical or surgical, which is indicated should be carried out irrespective of the complicating insanity. Women suffering from violent mania, control of whom would be difficult or impossible, are exceptions to the rule. If the local disease has antedated the insanity the prognosis as to recovery from the insanity is better than though the reverse were true.

TREATMENT OF INOPERABLE CARCINOMA.

When carcinoma has spread to such an extent that its radical excision is no longer possible, treatment resolves itself into meeting the symptoms as they arise

and rendering the patient as comfortable as possible. The symptoms which call for attention are hemorrhage, putrid discharge, and pain. The first of these will be ameliorated by employing, at the outset, curetage and cauterization as described on page 368. Hemorrhage and discharge subsequent to the palliative operation are favorably influenced by the application to the cancerous area of small pledgets of cotton (1 cm. in diameter) which have been soaked in equal parts of formaldehyd (25 to 40 per cent.) and adrenalin chlorid. The excess should be entirely pressed out so that the pledgets are wet, but not dripping even under pressure, and then they should be closely packed into the carcinomatous excavation. Care should be taken that the pledgets are not brought in contact with healthy mucosa. Immediately after making this application a tampon soaked with sweet oil should be introduced into the vagina. Under the influence of the formaldehyd and adrenalin the carcinomatous areas become hard and board-like; a superficial slough forms which is cast off in about a week; the odor of the discharge becomes less foul, and hemorrhage is controlled. The pain attendant upon the procedure is not great. Treatment of this sort should not be used oftener than once in ten days or two weeks. The oil tampon is removed twenty-four hours after its introduction. No attention need be paid to the cotton pledgets; they will be passed out in the course of douching, which should be done every day. A solution of potassium permanganate, 1:10,000 to 1:5000, is the best deodorizing douche. It has the advantage also that it does not replace the putrid odor with another one which, to some individuals, may be objectionable. A solution of carbolic acid, 1:1000, of creolin, 1:250, or of thymol, 1:1000, may be used. After douching, the vulva is carefully dried and dusted with talcum powder. Hemorrhage may be controlled by the application of adrenalin and formalin, just mentioned, or by the use of astringent and hemostatic injections. Thus, adrenalin chlorid (1:1000), tannic acid (1:10), or Monsell's solution (1:200) may be employed. Vaginal tamponade will be required at times. The pain from uterine carcinoma, especially in cervical carcinoma, may be very distressing, especially in the late stages. Although the various synthetic, analgesic, and antineuralgic remedies may be employed at first, it usually becomes necessary to use some of the preparations of opium. It is well to begin with codein (gr. $\frac{1}{8}$ to gr. ij). The dose at first should be small and it should be increased only very gradually. Morphin is required eventually, as a rule. The disagreeable effects of opiates (nausea, vertigo, and constipation) are reduced by the use of bromids and belladonna. It is always well to combine strontium bromid and belladonna or hyoscyamus with an opiate, except when it is exhibited in suppository. In suppository the bromid must be omitted.

THE TREATMENT OF INOPERABLE CARCINOMA BY MEANS OF THE X-RAY.

Dr. Henry K. Pancoast, the official skiagrapher of the University Hospital, has furnished the authors with the following résumé of this question:

With no pretence at conservatism it may be stated that without exception the X-ray treatment of carcinoma of the uterus and of the appendages is to be used only in inoperable cases or as a post-operative prophylactic measure. In either application it has a range of usefulness of sufficient merit to give it recognition as one of the methods to be frequently employed in the treatment of carcinoma. While it does not accomplish nearly all that has been claimed, it is to be hoped and expected that future study and experience and further improvements in technic and apparatus will lessen the uncertainty of the desired results.

The possible results to be obtained by X-ray treatment in uterine carcinoma may be classed under three heads:

1. *Cures.*—Permanent cures are as yet to be looked upon, in reality, with doubt, but theoretically they should be possible, as symptomatic cures are recognized, and there is reason to believe that they have been accomplished, with the absence of all signs of disease, for a time at least. The ideal case for X-ray treatment is one in which the growth is small and circumscribed, and capable of complete extirpation, as far as can be judged by the operator. In such a case the rays should be able to destroy, in most instances, any foci of disease still present, but not discernible at the time of the operation, provided such areas are so situated as to be in direct range of the rays applied through the vagina. Such cases are unfortunately not frequent; whenever the complete removal of a growth can be successfully accomplished, however, it seems reasonable to suppose that a post-operative course of X-ray treatment would give the patient a better chance of ultimate cure. The efficiency of Röntgen treatment in areas which are beyond the range of direct rays is doubtful.

2. *In the case of an extensive growth which may be removed in part by operation, a cure cannot, of course, be expected, but the X-ray treatment may still have a favorable influence.* In the first place, it may prolong the life of the patient. This is a fact worthy of recognition in many instances. The relief of pain has been observed by reliable authorities, and so frequently, too, that it must be recognized as a commendable result due directly to the treatment, and not to psychic effect. Pain is relieved in a large percentage of cases. This probably results largely from the direct anodyne effect of the rays. When the pain is due to pressure of a mass upon large nerve-trunks, little relief can be expected. A lessening of the discharge and a decrease or a cessation of hemorrhage are frequently among the favorable results, and are often brought about early.

3. *Although it is not, as a rule, advisable to treat a patient simply for the psychic effect, nevertheless there are instances in which this is a desirable result, and is all that can be accomplished.*

As to the technic of treatment, there are three methods of directing the rays upon the affected areas in pelvic carcinoma. The first is through the vagina, which is distended with some form of speculum. It is fully recognized in X-ray therapeutics that superficial cancerous growths are many times more amenable to treatment than those which are deep-seated, and that the

further the disease lies below the surface, the less is the likelihood of a favorable result. The first principle of Röntgen therapy is that the rays to be used in the treatment of any condition are those which will be absorbed entirely, or nearly so, in the tissues which are to be influenced by them. If a speculum is introduced into the vagina so as to expose all or a part of the growth, little or no healthy tissue is traversed by the rays. The rays used here should be of such a quality that they do not penetrate deeply, and are absorbed by the growth; such a result is to be obtained, speaking in general terms, from a soft tube; the deeper the penetration required, the higher should be the constant vacuum of the tube. The bulb should be placed as close to the patient and the speculum as is possible with safety. The dorsal position of the patient is generally preferred, though the Sims position may be used. Numerous varieties of specula have been devised for this purpose, but any will answer which properly exposes the area of the disease, has a sufficiently large external orifice to admit a cone of rays that will fill the internal orifice, and will entirely protect the healthy vaginal walls from exposure. Either a metal Ferguson speculum or some variety of valve instrument is generally employed. The tube should be so placed that the rays from the anticathode are directed as nearly parallel as possible to the walls of the speculum. Great care should be taken to protect the vulva and the other external parts from exposure to the rays; otherwise an annoying X-ray dermatitis may result. At present some form of tube shield is invariably used in therapeutic work, but while this is desirable it is not always sufficient. It is wise to surround the speculum with a metal collar, preferably of lead, or to cover the parts with some other protective material. In the light of our present knowledge of X-ray effects, it is not proper to have the instrument held in place by an assistant, therefore the speculum should be securely fixed so that it cannot become displaced. The patient should be placed upon a non-conducting table, and should not be touched by any one while the current is passing through the tube.

A second method of application through the vagina is by the use of a tube so constructed that a part of it may be introduced up to the seat of the disease. The cathode stream is projected through this tubular prolongation and the rays emanate from the glass end, which is kept cool by a water-jacket, or from a metal target near the end. Theoretically this is an ideal method, but it has been found, so far, to have but little practical value, mainly on account of the feeble penetrating quality and comparatively small quantity of the rays produced. It is to be hoped that some satisfactory form of tube of this variety may be devised.

The third method of treatment is the introduction of the rays from the outside through the anterior abdominal wall and from the sides and back. This method is frequently employed in conjunction with intravaginal applications, and is the only recourse when the growth cannot be properly reached through the vagina. The efficacy of rays so introduced is doubtful. A rather hard tube should be used in order to get greater penetration, and all parts of the body not to be exposed should be carefully shielded. Recent experiments have shown that a filter made

of wet sole leather or aluminium, placed between the exposed skin and the tube, offers some protection against dermatitis by filtering out those rays which would be absorbed by the skin.

The attempt has been made to increase the efficiency of the rays by introducing into the tissues in various ways certain substances which are rendered fluorescent or phosphorescent when acted upon by X-rays. So far there have been unsatisfactory proofs of the value of this procedure. Likewise, it may be said that radium has no practical value as a therapeutic agent in the treatment of uterine carcinoma.

The length of the exposure and the duration of the treatment are dependent largely upon the individual case and the variety of the apparatus employed. The treatment should, of necessity, be vigorous, and should be continued for some time after a symptomatic cure is obtained, if one be so fortunate. It would be wise to give a series of treatments every four or six months for a year or two.

During X-ray applications the indications for any constitutional or additional local treatment should be carefully observed and met.

TECHNIC OF INTRAUTERINE TAMPONADE.

It is sometimes necessary to pack the uterine cavity in order to arrest hemorrhage. Although tamponade of the uterine cavity is, in a measure, a surgical procedure, the indications for it may arise suddenly and require instant attention. Every physician, therefore, should be able to pack the uterus if occasion requires it. The necessary instruments are a Sims speculum, two double tenacula, a Fritsch-Bozeman intrauterine catheter, and a packer. A fountain syringe, sterilized gauze pads, boiled water, and the usual cleansing and disinfecting solutions should be at hand. The material used for the tamponade is preferably gauze which has been folded into long strips with smooth edges; any sterile material is permissible in a case of emergency. If nothing more suitable is at hand, ordinary gauze bandages 1 to 2 inches wide, boiled for five minutes and then squeezed dry, will answer. In every case, the external genitalia and the operator's hands and instruments should be disinfected.

The patient should be placed with her buttocks resting on the edge of the bed and her feet supported by chairs. A Kelly pad may be improvised in case of necessity. Before carrying out the procedure a bimanual examination should be made in order to determine the position and the size of the uterus. This is most important, for without a knowledge of the position and the size of the uterus the physician will not only be unable to introduce a firm tamponade, but may also do considerable damage to the uterine walls, or even cause a perforation. After locating the cervix with the examining finger, the anterior lip should be firmly caught by a tenaculum introduced along the finger as a guide. The cervix should then be drawn down and a Sims speculum introduced to retract the posterior wall of the vagina. All of the clots collected in the vaginal vault should be removed by means

of sterile water and gauze sponges until the cervix can be plainly observed. The cervical canal is straightened out by further traction upon the tenaculum, and a Fritsch-Bozeman catheter, with irrigating solution flowing through it, is introduced into the cervical canal. If there is any resistance to the introduction of the catheter, increased traction should be made upon the cervix and the end of the catheter should be gently pressed in a slightly different direction. The difficulty will usually be overcome by this simple maneuver; if there seems to be any serious obstruction the physician should desist from his attempts and be satisfied with a firm tamponade of the vagina. If the catheter enters easily it should be passed as far as it will go without resistance, provided this does not amount to more than the length of the uterus, as previously determined by bimanual palpation. Usually at a point which corresponds to the estimated length of the uterine cavity the catheter will impinge upon the fundus and a sense of slight resistance will be felt. If resistance is not met with at this point further introduction of the instrument is unadvisable. The uterine cavity should be washed with water at a temperature of 110° F., or as hot as can be borne upon the forearm. Care should be taken that there is a constant return flow from the uterus. A dram of adrenalin solution may be added to each pint of the irrigating solution. After the uterine cavity has been cleared of blood-clots and the stimulating effect of the irrigating fluid has promoted contraction of the uterine muscle, tamponade should be done without further loss of time. The catheter is removed; the vagina is dried, and the end of a strip of gauze is carried upon the tip of the packer (Fig. 42) to the top of the uterine cavity; the packer is then slightly withdrawn and again pushed upward; in this way at each withdrawal and insertion the gauze strip is caught and pressed upward and the endometrial cavity is filled from above downward. It may assist the physician to catch each lip of the cervix with a tenaculum. This sometimes makes the cervical canal straighter and there is not so much chance of meeting with resistance to the pack from the posterior cervical lip. The gauze should be introduced in one strip; or if more than one is required to fill the cavity, the end of each strip should be left hanging out of the cervix. After filling the uterus, the pack should be continued in the vaginal vault, first back of the cervix, then at the sides, and then in front, the tenacula being removed when required. A tamponade such as the one described ought not to be left in position for more than thirty-six hours. At the expiration of that time it should be removed. It may be replaced by another tamponade if the hemorrhage persists; but the vagina must be disinfected and the uterus washed out again before it is introduced. With each reintroduction of a tampon the risk of infection is increased.

CHRONIC CONSTIPATION.

A large number of women suffer from chronic constipation. This is partly due to the sedentary life which they lead. Other reasons for the greater frequency of chronic constipation among women than among men are. A habitual disregard

of nature's call for as long a time as possible; a loss of muscular tone in the abdominal wall, which results from the persistent splinting of the abdomen with corsets, or from obesity or overdistention; and indiscretion in diet, with the substitution of sweetmeats, condiments, etc., for the more wholesome and nourishing foodstuffs. Nervousness also interferes with digestion and the proper evacuation of the bowels. When the constipated habit has existed for some time secondary changes occur which are difficult to overcome except by prolonged treatment. The colon becomes dilated, and from the more or less constant distention with fecal matter the sigmoid flexure and the transverse colon may be dragged below their usual level. In this way the colon is kinked and the dilated and weakened muscular coat of the gut is unable to overcome the obstruction to the fecal current.

It should not be forgotten that chronic constipation may be due to stricture or to tumors of the bowels, to the pressure upon the rectum of a misplaced uterus, or of a tumor of the uterus or of the ovary. Pelvic inflammatory disease also may be responsible for constipation.

A careful search should be made in every case before treatment is begun, in order to determine whether there is any organic lesion which mechanically interferes with the normal evacuation of the bowels. Should such a lesion be found, steps should be taken to correct it as far as possible before other treatment is instituted.

The most important part of the treatment and the part which is most apt to result in permanent relief is that which pertains to the diet, exercise, and personal hygiene. Cereals, green vegetables, and fruit should be eaten freely; the first two because of the large residue which is left in the intestine after digestion to excite peristalsis, and the last because of its laxative effect. In the selection of the cereals, vegetables, and fruit, attention should be paid to the individual's digestive power and to any idiosyncrasies in this direction which she may exhibit.

The patient should be advised to go to stool daily at a fixed hour. This practice should be observed even though at first there is no desire to evacuate the bowels.

A certain daily amount of muscular exercise is almost indispensable. If walking or riding or some of the outdoor pleasures or sports are impracticable, a substitution indoors can be found in dumb-bells, Indian clubs, or free movements. There are few persons who find it impossible to walk for an hour each day in the open air if they are willing to do so, and few who are not able to use some form of exercise in their rooms before going to bed or after rising.

The abdominal muscles may be considerably strengthened by bending forward and touching the toes with the finger-tips and then reassuming an erect position with the arms held upright. An admirable exercise is for the patient to lie upon her back and flex the thighs upon the trunk, and then slowly extend them so that the patient lies supine. The trunk is then flexed upon the thighs, so that the patient assumes a sitting position, with the lower extremities extended upon the floor. The extremities are kept in this position while the patient slowly resumes a supine posture. Massage of the abdominal muscles and of the colon itself is often of great

service in the cure of constipation, and may be used in combination with the movements just described.

Drugs.—It will be necessary until the effect of the general measures asserts itself to use a laxative cathartic every day. A very convenient and efficient one is a pill composed of aloin, gr. $\frac{1}{4}$; cascarn, gr. $\frac{1}{4}$; podophyllum, gr. $\frac{1}{6}$; ext. belladonna, gr. $\frac{1}{8}$; strychnin sulphate, gr. $\frac{1}{60}$, and oleoresin of ginger, gr. $\frac{1}{16}$; or the ordinary aloin, belladonna, and strychnin pill may be used; or cascara sagrada (gr. ij-v) in pill or the aromatic fluidextract (f3i-3ij) may be tried. The tincture of aloes and myrrh (f3j-3ij) or the Lady Webster pill often acts well. In cases of constipation complicated by anemia (stercoral anemia) the daily use of a laxative should be combined with the administration of iron. The anemia in these cases is aggravated by an intoxication which results from the retention of fecal matter within the intestinal canal. A favorite prescription¹ in such cases is the following:

R.	Magnesi sulphatis	3iv
	Ferri sulphatis	3ss
	Acidi sulphurici dil.	f3ij
	Aquæ	f3xvj
M. and S.	Tablespoonful every morning on awakening, in a half tumblerful of cold water.	

In many cases of chronic constipation where the patient suffers from headache, vertigo, anemia, lassitude, and in which there is a probability that intestinal absorption has produced a form of toxemia, lavage of the colon is of great service. For this purpose warm salt solution (a heaping teaspoonful of common table salt to a quart of water) may be used. The reservoir should be hung but slightly above the level of the buttocks so that the solution does not enter the rectum with sufficient force to provoke contractions. The patient assumes the knee-chest position and maintains it throughout the procedure, or she lies first on the left side with the hips elevated until one quart of solution has been used, then takes the knee-chest position for the second quart, and then lies on the right side for a third quart. The sequence of positions is for the purpose of assisting the flow of the fluid first into the descending colon, then into the transverse, and finally into the ascending colon as far as the cecum. The solution may be introduced into the rectum by means of the ordinary fountain syringe and rectal nozzle, or the rectal tube may be inserted, by means of which the solution is introduced into the sigmoid or into the descending colon.

Lavage of the colon, if repeated daily for a long period, may become an almost indispensable measure to secure an evacuation of the bowels. It can be productive of harm only by causing an overdistention and relaxation of the colon. This can be fairly well guarded against by using, as a rule, not more than two quarts of solution. In all long-standing cases the necessity for regular and systematic exercise must be insisted upon.

¹The amount of Epsom salts in this recipe should be increased if necessary.

CHAPTER V.

NON-PLASTIC OPERATIONS OF THE VULVA AND VAGINA.

By ANNA M. FULLERTON, M.D.

Surgical affections of the vulva and vagina present for our consideration the following conditions, either alone or in combination:

1. Inflammatory diseases, including eruptive disorders.
2. Traumata.
3. Ulcerative processes or their results.
4. Hypertrophy of tissues and organs.
5. Atrophy.
6. New-growths.

The operative measures called for in the management of these conditions are chiefly *excision* and the application of sutures, or *cauterization*.

Such operations are simple and accompanied by little risk because of the accessible position of the organs operated upon.

In operations about the clitoris particularly the vascularity of the structures may lead to free hemorrhages, but this can be readily controlled. When strict aseptic precautions are observed, prompt healing may be looked for.

The proper application of aseptic protective dressings and rigid surgical cleanliness, both in operative and post-operative management, are essential to success.

The instruments usually required are scalpels, bistouries, curved and straight scissors, rat-toothed forceps, hemostatic forceps, a needle-holder, curved and straight needles, curets, snares, and sometimes a thermocautery; for vaginal operations specula and retractors will be needed.

The *suture materials* most frequently employed are silkworm-gut for deep sutures and catgut for those used in approximating the edges of superficial wounds. Linen thread prepared with celloidin has been used with success in place of silkworm-gut. Silkworm-gut and thread sutures require removal within a week or ten days following the operation.

INFLAMMATORY AFFECTIONS OF THE EXTERNAL GENITALS.

Vulvitis.—(See page 246.)

Agglutination of the labia may be caused by vulvitis, especially in children, by the destruction of the epithelium on apposed surfaces. Adhesions of the hood of the clitoris to its glans result from similar causes.

Adherent surfaces may be stripped apart by a probe under cocain anesthesia.

The separated surfaces should be kept from reuniting by the use of an antiseptic powder or a bland ointment, or by packing between them strips of antiseptic gauze.

Pruritus vulvæ.—For the etiology, symptoms, diagnosis, and medical treatment, see page 254. When pruritus vulvæ is so intractable that medical treatment does no good, the plan first proposed by Schroeder, *i. e.*, excision of the affected skin, followed by plastic repair, should be carried out. Hirst has had two successful results by resection of the nerves which supply the affected parts. The resection of the pudic nerve alone cannot be expected to cure a pruritus vulvæ; the only method certain to accomplish this result is to resect all of the sensory nerves of the part. This can be done by making four incisions, two in the groin, corresponding to the incisions for an Alexander operation, and two on the buttocks. The latter are parallel with the ascending ramus of the ischium, begin just above the tuberosity, and are two inches long. By the groin incision the genital branch of the genitocrural and the ilioinguinal nerves can readily be exposed. After isolating the nerves they are divided and as long a distal portion as possible is removed from each. The inferior pudendal nerve is found crossing the ramus of the ischium an inch above the tuberosity. The perineal branches of the pudic are less easily discovered, but painstaking dissection will usually isolate them in the upper outer part of the ischiorectal fossa. The posterior superficial perineal branch is found on the fascia to the inner side of the ischiatic ramus. When the clitoris is involved its dorsal nerve should be resected. This lies beneath the inferior layer of the triangular ligament, alongside the inner surface of the ascending ramus of the ischium and to the outer side of the pudic artery. This operation is not followed by atrophy of the vulva, and in three out of four cases in Hirst's hands has resulted in a cure.

Inflammation and Abscess of the Vulvovaginal Glands and their Ducts.—

The ducts of the vulvovaginal gland may be the seat of an initial gonococcus infection or discharges from the vulva and vagina which are of a purulent character, particularly those of the gonorrheal variety, may infect them.

The *symptoms* are tenderness with slight tumefaction of the lower part of one or both labia and a mucous or mucopurulent discharge that can be pressed out of the reddened orifice of the duct. If the duct is occluded, a round, elastic, tender tumor is formed in the lower part of the labium, varying in size from a hazelnut to a walnut, according to the amount of the accumulation. When the gland is much distended, and when the contents is pus, the condition may cause great distress and confine the patient to bed. Occlusion of the duct, producing an accumulation of mucus through retention, causes a *cyst formation*. Inflammatory involvement of the gland with the formation of pus results in an abscess.

In the milder cases antiseptic vulval washes, hot sitz-baths, or hot alkaline fomentations, with evacuation of the gland several times a day by careful pressure, may be sufficient to produce a cure. A cure is even more likely if evacuation of the gland is followed by the injection into it, by means of a blunt hypodermic needle, of a 25 per cent. solution of argyrol. *Dilatation of the opening of the duct* by a

fine probe may cause a free evacuation. A cure may be insured by excision of the gland followed by suturing of the wound. *Incision* and *packing* are sometimes employed, but are often followed by recurrent suppuration; hence it is not to be recommended except in the cases of acute abscess either of the gland alone or of the gland and labium combined.

Incision may be effected by a narrow sharp-pointed knife plunged through the skin into the abscess, slitting it open. The cavity of the abscess is then cleansed and painted with pure carbolic acid and packed with iodoform gauze. The gauze



FIG. 174.—CYST OF THE VULVOVAGINAL GLAND.
Showing the large size which these cysts may attain. Dr. Noble's case.

is changed from time to time and the cavity cleansed until it closes by granulation. *Complete extirpation* of the gland is effected by making an incision through the skin surface of the labium over the whole surface of the enlargement. The edges of the skin incision being pressed down on each side, the enlarged gland bulges forward and may be rapidly dissected free from its attachments by means of a blunt dissector or a scalpel. The close attachment to the deep cellular tissue under the pubic ramus may require the use of a knife or scissors, the gland being grasped by the fingers and drawn

forward. Care should be taken in securing the attachments of the gland to avoid cutting through the thin mucous surface on the inner aspect of the labium. One should avoid rupturing the gland if it is cystic so as to prevent the escape of its contents over the wound. It is also more difficult to find and remove all parts of the gland wall when collapsed. The removal of the gland leaves a deep cavity in the labium from which there may be considerable hemorrhage. Persistently bleeding vessels should be ligated with fine catgut. After thorough cleansing of the cavity by an antiseptic solution, interrupted sutures of silkworm-gut or silk should be employed for bringing together the surfaces, each suture reaching to the bottom of the wound so that no pockets may be left for the accumulation of blood and the formation of a hematoma. Dry dressings should be kept applied and the sutures removed in a week or ten days.

Cyst of the Vulvovaginal Gland.—At times, as a result of a mild grade of inflammation of the duct and gland, occlusion of the duct and cyst formation result. This may also follow a badly made denudation in perineorrhaphy by which the orifice of the duct is removed and the gland itself is buried in the wound.

The *symptoms* are usually mechanical and depend upon the size of the cyst. At times inflammation and abscess result.

The *diagnosis* of such a cyst is easy from its location, its ovoid form, and the manifest fluctuation.

The *treatment* consists in the extirpation of the tumor as already described in the preceding section. Incision and packing are not to be recommended. Fig. 174 shows the large size which these cysts may attain.

Gangrene or noma of the vulva is a highly infectious and exceedingly fatal disease usually occurring in young children of lowered vitality who live in squalor and filth. Redness and infiltration of one of the labia, with an ichorous discharge, are first observed. Later, vesicles appear, assuming a grayish-green color and rapidly becoming gangrenous. Prostration is extreme and requires supporting internal medication and forced feeding. If recognized before extensive infiltration has occurred, *excision* of the affected parts is advised. Should this leave too large a wound for union by sutures, antiseptic washes should be used every three or four hours, weak solutions being kept continuously applied by means of wet compresses. It is well to change the antiseptic agent occasionally to avoid poisoning by absorption.

TRAUMATA.

Pudendal injuries may be the result of falls or blows or of roughness in sexual intercourse. Should the corpora cavernosa be injured serious hemorrhage may result. The usual site of physiologic lacerations of the hymen is on either side of the posterior commissure. They may be stellate. The shape of the hymen and its orifice will largely determine the size and direction of the lacerations. Wounds of the pudenda require *similar treatment* to those occurring elsewhere, contusions being treated by soothing applications, while lacerations require closure by deep sutures for the control of the deeper blood-vessels and the prevention of extravasation of blood, the formation of hematoma, and perhaps, subsequently, of an abscess.

Hematoma of the vulva, thrombus of the vulva, or vulvovaginal hematocele may result from hemorrhages into the tissues of the vulva, the result of accidental injuries to the corpora cavernosa, or they may be caused, during labor, by rupture of the blood-vessels induced by extreme bearing-down efforts on the part of the patient or by pressure of the child's head. They are usually unilateral and range in size from a walnut to a child's head. There is no heat or redness unless suppuration is threatened, but the distention of the tissues causes a sense of discomfort. Sometimes a burning pain is complained of and also tenesmus of the bladder and rectum. Winckel has estimated that it occurs once in 1600 cases during parturition.

Treatment.—If the tumor be recognized as increasing in size, the application of an ice-bag may prevent its further increase. If small and not increasing in size it may be let alone, with the expectation that it will soon be absorbed. Spontaneous rupture may occur from extreme distention, or the blood may become encysted, and if the hematoma is large it may be very slow in its absorption, in which case *incision* is indicated. The most satisfactory management is that of free incision, turning out the clots, sterilizing the cavity, and closing the wound with deep sutures. Even if suppuration has occurred, if the abscess is well excised, the closure of the wound is desirable, provision for drainage being made. Should the above treatment not be practicable, *incision*, disinfection, and loose dry packing of the wound with antiseptic gauze is the best procedure. The packing is repeated as required until the cavity contracts.

Rupture of Varicose Veins of the Vulva.—Immense distention of the blood-vessels of the vulva, the result of pressure caused by intrapelvic tumors, the gravid uterus, etc., may frequently threaten rupture. The patient complains of a sense of fullness, or itching, or vesical tenesmus. Some relief may be obtained by the use of a vulvar pad, kept in place by a T-bandage, frequent rest in the recumbent position, regulation of the bowels, avoidance of continuous standing and lifting, and by the employment of astringent washes. When rupture of a varicose vein occurs, control of the vessels by *ligature* is the best method of procedure, although *compression* may temporarily control the hemorrhage.

ULCERATIVE PROCESSES.

The principal ulcerative processes affecting the vulva, apart from the loss of continuity of tissue which may accompany the specific eruptive diseases or follow trauma, are:

1. Simple ulcer of the vulva.
2. Lupus vulgaris, or tuberculosis of the vulva, first described under the name of "esthiomène."
3. Epithelioma of the vulva, probably the same condition that has been called "ulcus rodens."

Rarely ulcers of the vulva are found which clinically resemble lupus vulgaris or

epithelioma, but in which no microscopic evidence of these diseases can be demonstrated. In spite of a lack of positive evidence it is reasonable to believe that some of these ulcers are either tubercular or venereal in origin. Some of them are due to malnutrition, uncleanness, and a lack of treatment.

The *treatment* of simple ulcers which cannot be healed by topical or general measures is by excision and suture.

Tuberculosis of the vulva, according to J. Whitridge Williams, occurs less frequently than tuberculosis of any other part of the genital tract. The presence of tubercle bacilli should be demonstrated in scrapings from the ulcer, or inoculation experiments should be employed to prove the diagnosis. Howard Kelly considers that the disease is usually associated with pulmonary tuberculosis. It may occur in the form of miliary tubercles or of tubercular ulcers. It begins on the cutaneous portion of the vulva, as a rule, although some cases appear to be confined to the mucous surfaces. There may be several hard masses or nodules or but one large mass of a livid dark red color, the skin around it being indurated. Over these surfaces brighter and projecting tubercles appear which in several weeks or months begin to ulcerate and are covered by a serous exudate. The appearance is that of an unhealthy ulcer. The base is hard, does not readily bleed, and is composed of friable granulation tissue. The tendency is to spread. The process may extend over years and be accompanied by cicatricial contraction in some places, resulting in more or less deformity. The lymphatic glands become affected during the progress of the disease and sometimes the internal organs become involved. The chronic character of the affection distinguishes it from malignant disease.

Treatment by extirpation has heretofore been the most satisfactory measure. When this is not possible the *use of the sharp curet*, followed by *cauterization* of the surface with a strong acid, may be tried and repeated each time the disease returns. Treatment by means of the X-ray and the Finsen light should be given a fair trial. Analogy would suggest that these agents will prove as valuable for tuberculosis of the vulva as for the same affection on the skin elsewhere.



FIG. 175.—SIMPLE ULCER DESTROYING LEFT LABIUM MINUS, FOURCHETTE, AND RIGHT LABIUM MINUS AND MAJUS.

Slides showed dense round-cell infiltration but no sign of tuberculosis.

Epithelioma of the vulva usually begins quite insidiously. A small indurated elevation on the inner side of the labium, covered by thickened layers of squamous epithelial cells, may escape the notice of a patient for a long time, or may be discovered quite accidentally. After some months this nodule, which has slowly increased in size, becomes an ulcerated surface by the breaking down of the skin. A thin puri-



FIG. 176.—TUBERCULAR ULCER OF THE VESTIBULE.

form fluid of disagreeable odor exudes from the surface. The edges and base of the ulcer are indurated, and granular and papillary excrescences may appear upon the surface. The symptoms are at first simply slight itching accompanied at times by shooting pains. Later there will be local irritation from the discharge and the hemorrhage.

Extension of the disease occurs over the vulvar and the skin surfaces (Fig. 177).

The inguinal glands become infected, septic absorption soon follows upon necrosis of tissues, and extreme debility supervenes.

The disease usually terminates fatally in about two years. Mundé¹ states that the disease occurs once in about 35 to 40 cases of cancer of the female sexual organs.

The *treatment* is *early extirpation* of the diseased tissues with suture of the wound. If the edges of the wound cannot be satisfactorily approximated, thorough *cauterization* of the surface by the thermocautery may be employed, or some chemical styptic may be used, with subsequent dressing with iodoform and tannin powder.

Hart² makes the statement that epithelioma of the vulva is sure to return.



FIG. 177.—EPITHELIOMA OF THE VULVA.

An advanced growth of the left labium majus with involvement of the left inguinal glands. Case of Dr. James S. Carpenter, of Pottsville, Pa., operated upon by Dr. Noble.

Hirst,³ referring to this statement, claims that thorough removal of the affected tissue with the inguinal glands which are involved may result in a *cure*. Hirst mentions also in the same article a form of syphiloderm of the vulva so closely resembling epithelioma as only to be differentiated from it by the therapeutic test or by the microscope.

Noble⁴ reports a case of epithelioma of the clitoris operated upon in 1901 in

¹ Mundé, P. F.: "Two Cases of Primary Epithelioma of Vulva and Vagina," *Amer. Jour. Obstet.*, May, 1889, vol. xxii, p. 476.

² Hart, Berry: "Epithelioma Vulvæ," *London Practitioner*, February, 1895, vol. liv, p. 118.

³ Hirst, B. C.: *Clinical Notes*, *Amer. Jour. Obstet.*, June, 1895, vol. xxxi, p. 869.

⁴ Noble, Charles P.: "Report of Case of Epithelioma of the Clitoris with Operation," *Am. Jour. Obstet.*, vol. xlv, No. 2, 1902.

which the vulva and the inguinal glands were removed. In 1906 the patient remained well.

Atresia of the vulva, resulting from a cicatricial contraction following upon an ulcerative process affecting the tissues of the vulva, may demand operative treatment by free *incision* and *dilatation* in order to render the orifices patulous. After the incisions have been made, gauze packing or the use of a bougie or a dilator will be required for some time in order to prevent recurrence of the stenosis. Whenever feasible the mucous membrane of the vagina should be loosened and sutured to the skin in order to maintain a patulous vaginal orifice.

HYPERTROPHY OF THE VULVA.

Elephantiasis is a term more accurately applied to the disease, known in the tropics as *Elephantiasis Arabum*, which affects the labia majora, clitoris, and even the labia minora. The disease is a result of stagnation in the lymph-channels and

is caused by their obstruction through the presence in the blood of the embryonic forms of a parasite known as the *filaria sanguinis hominis*. The skin is greatly hypertrophied, so that large tumors are found hanging from the genitals and invading surrounding structures. In this country the term is applied to enlargements of the external genitals, the result of chronic inflammation from whatever cause. The surface of the skin may be smooth (elephantiasis glabra), warty (elephantiasis vermicosa), or papillary (elephantiasis papillomatosa). The consistence of the tissue may be hard or soft.¹

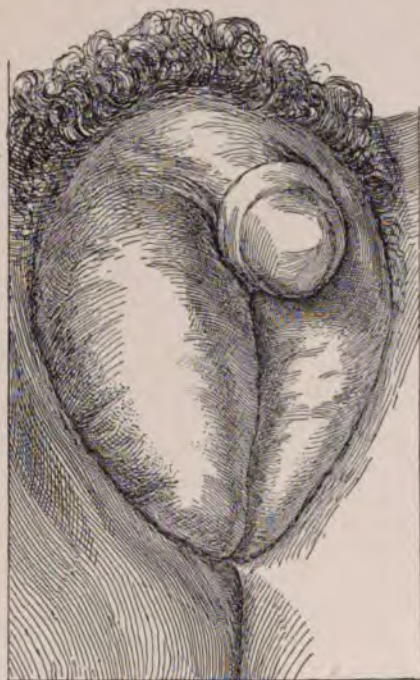


FIG. 178.—SYPHILITIC HYPERTROPHY OF THE LABIA MAJORA AND CLITORIS.

Syphilis is one of the most common exciting causes of hypertrophy in this country. The involvement may include both sides of the vulva. The disease is of rapid growth and excoriations may be produced over the surface of the tumor by friction of the clothing (Fig. 178).

The *symptoms* are chiefly those of discomfort resulting from the dragging weight of the vulvar mass. Some cases have been reported² in which the condition was attended with great pain, the suffering being worst at night. Painful micturition or incontinence sometimes results from

¹ Byford, H. T.: "Manual of Gynecology," Phila., 1902.

² Kelly: "Operative Gynecology," vol. i, p. 181.

involvement of the urethra. Leukorrhea is usually profuse. When a specific source can be traced, it is well to give palliative treatment by alteratives a trial, particularly if the enlargement be of moderate size. *Excision* of the hypertrophied structures is usually called for.

ATROPHY OF THE VULVA.

Various terms have been applied by different authors to this morbid condition, the true pathology of which has yet to be determined. It was described by Breisky, in 1885, who applied to it the term "*kraurosis vulvæ*," meaning a shrinkage of the vulva. This term simply describes the general appearance of the parts. Breisky gives us the following picture of the affection: "The skin and mucous membrane in the region of the labia majora and minora, the perineum, and the entire entrance to the vagina, shrink up, grow dry, and acquire a whitish appearance and are covered with a thick layer of epidermis. The number of sebaceous glands is diminished, the papillary body becomes cicatricial, the connective tissue sclerotic. Thereby the skin becomes tightly stretched, so that it tears extremely easily. Even the impression of the fingers in examining makes deep rents" (Fig. 179).



FIG. 179.—CASE OF PRURITUS AND KRAUROSIS.
Note the absence of the labia minora.

Robt. F. Weir,¹ of New York, in 1877 described the same condition, calling it "*ichthyosis of the vulva*." Lawson Tait,² in 1877, called it "*serpiginous vascular degeneration of the nymphæ*." C. A. L. Reed³ speaks of it as "*progressive cutaneous atrophy of the vulva*." Howard Kelly, in his work on "*Operative Gynecology*," has adopted for it the term "*vulvitis pruriginosa*" (vol. i, p. 198). The symptoms demanding treatment are intense pruritus and stenosis. H. W. Longyear,⁴ of Detroit, in a contribution to the pathology of the condition, considered that fibrous degeneration of the subcutaneous and submucous

¹ Weir, R. F.: "*Ichthyosis of the Tongue and Vulva*," N. Y. Med. Jour., 1876, vol. xxiv.

² Tait, Lawson: "*Diseases of Women*," 1879, p. 25, New York.

³ Reed, C. A. L.: "*A Text-Book of Gynecology*," 1901, p. 207, New York.

⁴ Longyear, H. W.: "*Kraurosis Vulvæ*," Amer. Jour. Obstet., December, 1895, vol. xxxii, p. 823.

cellular tissue constituted the first morbid changes of tissue structure. He describes the condition as follows:

"The new formation, by replacing the loose cellular tissue through which the nutrient vessels of the skin and mucous membrane pass, acts by gradual and continual contraction, as is peculiar to the elements of fibrous tissue, and results in the firm and unyielding constriction of the vulva and in the strangulation of the blood-vessels which pass to and from the overlying skin and mucous membrane. The presence of this new formation of fibrous tissue is of interest from a surgical standpoint, as it is evident that the band of constriction must be removed by any operation that is made for the relief of the stenosis of the vulva. The removal of the degenerated mucous membrane containing the brownish spots (found scattered over the cicatricial tissue) may relieve the acute sensitiveness of the parts, but will have no effect on the stenosis. Patients who recover spontaneously only recover so far as sensitiveness is concerned, as the constriction of the vulva, due to the band of fibrous tissue, will exist as a permanent condition."

The operation advised is analogous to Whitehead's operation for hemorrhoids. All of the diseased mucous membrane is removed and healthy tissue from the vaginal inlet is dissected loose from its basic attachments and slipped down and sewed to the skin, thus covering the denuded surfaces. Entire removal of the fibrous tissue underlying the diseased membrane is recommended.

Howard Kelly advises deep excision of all the structures involved, sometimes comprising the removal of the whole vulva, the edges of the wound being united by silkworm-gut sutures in such a way as to cover the defect.

TUMORS OF THE VULVA.

Pudendal varices, Hematoma, Elephantiasis, Cyst and Abscess of the Vulvovaginal Glands, and Abscess of the Labia have already received mention. Other tumors found in this region are as follows:

Cystic Tumor,	Carcinoma,
Papilloma, or Condyloma,	Sarcoma,
Lipoma,	Osteoma,
Fibroma,	Enchondroma,
Myxoma,	Neuroma,
Angioma.	

Hydrocele of the labium majus, cyst of the round ligament, or *hydrocele muliebris*, is an enlargement of the external genitalia, the result of an accumulation of peritoneal fluid in the canal of Nuck, the peritoneal sac extending along the round ligament into the *labium majus*. The tumor formed by such an accumulation causes enlargement of the upper part of the labium, as does a labial hernia, and is thus differentiated from a cyst of the vulvovaginal gland. When the neck of

the sac has not been closed, the tumor is reducible and varies in size with the position of the patient and the amount of abdominal pressure. When not reducible because of closure of the neck by an adhesive inflammation, the tumor is translucent, insensitive, and elastic. No tympany is obtained on percussion over it. When it is irreducible and the peritoneal cavity is cut off, aspiration may be practised. If it reappears it may, on being reaspirated, have a little tincture of iodine injected into it. If this fails, the *sac may be dissected out* of the labium and the wound closed by deep sutures.

Cystic tumors have been found in the substance of the round ligament, also in the connective tissue of the labium majus.

Small cysts of the hymen due to congenital arrest in development of the two layers have been described by some authors. Their treatment is by excision.

Papilloma or condyloma of the vulva may be of two kinds, simple and specific.

Warts of the vulva are quite frequently met with and are usually the result of syphilis or of gonorrhea. They may be caused by irritating discharges of a non-specific character, as the leukorrhea of pregnancy, especially when there is a lack of cleanliness.

The *condylomata acuminata* are gonorrheal vegetations—small, pointed growths differing from the syphilitic condylomata, which are flat and broad.

These warts may occur singly or in groups, scattered over the vulva and contiguous skin surfaces. Sometimes they extend up to the vault of the vagina. Aggregations of these may form cauliflower-like masses as large as an infant's head, of a pinkish or a purplish color, and often secreting an offensive sanious discharge, which produces a similar condition on any surface which it moistens by contact. The *treatment* is by *excision*. In the case of scattered warts, each one should be removed with curved scissors and the base touched with some caustic, as nitric or carbolic acid, or the edges of the resulting wound may be united by catgut sutures. The larger masses should be excised entire and the wound sutured.

Lipoma of the vulva may occur in the subcutaneous tissue of the vulva and sometimes grows to quite large dimensions. The lobulated appearance of the surface, owing to the intimate connection of the skin with the tumor, is a valuable diagnostic point. There is sometimes a slight sensation of fluctuation on palpation of the tumor.

A lipoma may be removed by an incision through the skin covering the tumor, when the mass itself is peeled out with little difficulty and the edges of the skin wound united by suture. Compression over the site of the tumor is desirable in dressing the wound to prevent the formation of a blood-clot.

Fibroma or myofibroma of the vulva may develop from the subcutaneous connective tissue in this region, originating in the labium majus, labium minus, clitoris, about the meatus urinarius, and in the perineum. Usually these tumors are polypoid and have a distinct and rather attenuated pedicle. They are composed mainly of fibrous connective tissue with some muscular structure (Fig. 180).

Myxomata occur in the same locality, being so named because of the preponderance of myxomatous tissue. The growth of these tumors is usually slow, unless a hemorrhage takes place in their interiors, when the increase in size may be sudden. Both the above classes of tumors are liable to ulceration of their sur-



FIG. 180.—FIBROMA OF THE LEFT LABIUM MAJUS.
Case of Dr. B. O. Coates, Cleveland, Ohio.

faces from friction and their *removal* is an operative procedure so simple and safe that they should always be excised and the wound sutured. No internal medication nor local applications have any effect upon them.

Cancer of the Vulva—Carcinoma.—The dermoid form of cancer, or epithelioma, has already received attention.

Medullary and scirrhus cancers are of still greater rarity in this location. These forms of malignant disease are more rapid in their development than epithelioma and the symptoms of systemic infection appear in quicker succession and are correspondingly more intense. The deeper lymphatics are affected sooner and pain occurs earlier and is more severe. The prognosis is naturally more grave.

The disease first appears in the form of nodules in the connective tissue of the labia majora or minora or about the mouth of the urethra. These lead to general infiltration, ulceration, and necrosis of tissue. Microscopic examination of the tissues should be used in the differential diagnosis between this and other ulcerative processes, as syphilis or lupus. Early *removal* is indicated. When the disease is too far advanced for extirpation, *curctage* of the surface with a subsequent application of caustic, as pure carbolic acid, and the application of antiseptic dressings may be employed. The wound will need frequent cleansings and a change of the dressings.

Sarcoma, prior to Virchow's time, was known as "encephaloid cancer," the same name being also applied to medullary cancer. Virchow first demonstrated the fact that whereas in cancer epithelial elements predominate, sarcoma is a connective-tissue growth, and is largely composed of embryonal or medullary tissue. Sarcoma of the vulva, either melanosarcoma or myxosarcoma, may arise from the labial surfaces or from the clitoris, or may commence in the deeper connective tissue. The progress is rapid, and ulceration, necrosis, and septic symptoms manifest themselves as in carcinoma.

The *differential diagnosis* between the two forms of malignant tumor may be made by microscopic examination of portions removed.

Sarcoma is apt to occur earlier in life than carcinoma. The progress is more grave, a fatal termination occurring within two years. The *treatment* is the same as for cancer—early removal. Either the knife or the galvanocautery may be employed in operating. The knife is preferred where it can be used, because primary union of the resulting wound may be obtained. There is thought to be less danger of hemorrhage in employment of the galvanocautery. In order to thoroughly extirpate the growth the whole chain of lymphatics on the side corresponding to the growth should be removed.

If the condition when observed is such as to warrant no radical treatment for removal, an effort may be made to control the ichorous discharge. All broken-down tissue may be removed by the sharp curet and then the actual cautery applied to the surface, which may subsequently be dressed with antiseptic powder or lotions applied on compresses kept in place by means of an occlusion pad. For the severe pain which the patient may suffer, narcotics will be required.

Other tumors of the vulva, such as the osteoma, enchondroma, neuroma, and angioma, are so rarely met with that they require but brief mention. They possess the same characteristics as when found elsewhere and require removal by *excision*.

VAGINAL AFFECTIONS.

Operations upon the vagina are comparatively rare. The removal of foreign bodies, as embedded pessaries, the evacuation of abscesses, plastic operations for the repair of lacerations or for the correction of congenital or acquired atresias or stenoses, and the excision of cysts and neoplasms, are those chiefly called for. The conditions commanding operations are very similar to those enumerated in the section on vulvar diseases.

Vaginismus, or **vaginodynia**, is a term applied to an abnormal spasmodic action of the muscles of the pelvic floor due to a hyperesthetic condition of the vaginal orifice, the vulva, and the surrounding parts. The bulbocavernosus, transversus perinei, and levator ani muscles may all be involved and sometimes the muscles of the thigh are also rigidly contracted. The patient is, as a rule, in a hysteric, neurasthenic, or debilitated condition, although fissures or inflamed ulcerated conditions of the vulvar or hymeneal orifices, or lesions of the anus or urethra, may be an exciting cause.

Attempts at coitus or the use of douches and digital examinations are apt to produce the spasm and excite a state of nervous terror. When such a condition is suspected the patient should first be examined without an anesthetic in order that the spasm may be appreciated. A more thorough examination under anesthesia may be required to determine the existence of any lesion as an exciting cause, although when the patient's attention is diverted, it is often found that quite firm pressure may be made by the examining finger within the vagina without eliciting pain or exciting spasm.

The *treatment* consists in the removal of the diseased conditions, and the application of remedies to diminish the sensitiveness of the superficial nerves, with the use of tonics, laxatives, sitz-baths, and general hygienic management. In intractable cases the vaginal entrance may be *forcibly dilated*, under anesthesia, by the introduction and withdrawal without closure of a widely expanded speculum; or preferably by bimanual dilatation. Subsequently treatment by tamponade of the vagina may be kept up every day or two, or the patient may be instructed to use a glass vaginal dilator, anointing it with cocain ointment, introducing it into the vagina, and wearing it for two to three hours daily.

Diseased carunculæ should be *extirpated*, also persistent fissures and ulcers. If the hymen be rigid or sensitive, it should be cut or excised, and the edges of the mucous membrane united by continuous suture. Marion Sims suggests that in cases where the perineum is high and the vaginal entrance small, two *lateral incisions* be made through the edges of the constrictor cunni, converging in the median line just above the sphincter ani to form a V. This may be done subcutaneously. Before and after incision the parts should be stretched. A vaginal plug (Fig. 181) should be worn by the patient for two hours morning and afternoon for several weeks.

Coccygodynia is a condition closely allied to the above, the affection consisting

in a morbid state of the coccyx or of the muscles attached to it which renders their contraction and the movement of the coccyx very painful.

A variety of causes seem to be responsible for this condition. Fractures, dislocations, or caries of the bone have been found in some cases. A hypersensitive state of the fibrous tissues surrounding the coccyx, of a rheumatic or a neuralgic character, appears in others to have been the cause of the suffering. It is probable that neuralgias due to uterine ovarian disease form the most frequent cause. General nervous exhaustion or neurasthenia is a very common accompaniment of the condition.

The *symptoms* are those of pain upon sitting down, rising, or making any effort. The passing of feces or attempts at coition will similarly cause suffering. The affection may last for years, annoying and distressing the patient. It may pass away in time, but usually requires the employment of measures for its relief.

If the disorder is secondary to uterine or ovarian disease or anal fissure, etc., the primary disorder should receive treatment. If the site over the coccyx is the primary seat of trouble, blistering, the use of morphin hypodermically, and the persistent use of the galvanic current, have been found beneficial. An iodoform or other sedative rectal suppository can be

used at the same time, and general means employed to improve the patient's health. Should palliative measures fail, recourse may be had to one of two radical operations—section of the diseased muscles or excision of the bone to which they are attached. The first operation was recommended by Professor Simpson and

is performed as follows: A tenotomy knife is carried under the skin on one side of the lowest point of the coccyx, then turned flat and carried up between the skin and cellular tissue until it reaches the sacrococcygeal joint, then it is turned so that in withdrawing it an incision is made which entirely frees the coccyx from muscular attachments. The knife is then introduced on the other side and the section repeated there. This subcutaneous method is not an easy measure, especially in fat women. It has therefore been recommended to make an incision over the entire length of the coccyx, lifting the exposed extremity of the bone with the finger, and then, with a pair of scissors, to sever the muscles (Mundé).

If the bone be diseased, the plan of Nott, of extirpating the coccyx, should be carried out. An incision being made over the coccyx, and the bone laid bare by severance of its attachments, the whole of it may be torn out by a pair of bone-forceps or disarticulated with a heavy knife or scissors. Where actual disease exists, relief can confidently be promised.

Vaginal Cysts and Abscesses.—Small vaginal cysts containing clear or slightly viscid and turbid fluid are not infrequently met with in or beneath the vaginal wall. Those of large size, larger or as large as a hen's egg, are quite uncom-

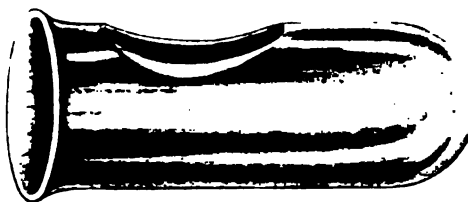


FIG. 181.—SIMS' GLASS PLUG.

mon. These cysts may be formed in any part of the vagina, and do not always originate from Gaertner's duct, as has been thought. The cyst wall is closely connected with the surrounding tissue and is usually lined with cylindric epithelium. The following classification, according to their origin, is given by H. A. Kelly:

- (1) From the vaginal glands.
- (2) From epithelial nests included in scar tissue following a trauma.
- (3) From Gärtner's ducts.

A suburethral abscess, discharging into the urethra on pressure, will often simulate a vaginal cyst.

The contents of true vaginal cysts may undergo suppurative change and form abscesses. They then cause some pain. The presence of small cysts is not accompanied by pain. The larger cysts bring about obstruction of the vagina and interfere with marital intercourse. They may also complicate labor. Large cysts may cause vesical and rectal tenesmus from pressure.

Operative treatment is simple. Excision of the small cysts without opening into them, and closing the wound with catgut sutures, is the most approved treatment. Large cysts may be opened, their cavities evacuated, the lining membrane of the cysts dissected out, and the wound closed by sutures, unless suppuration should have occurred, when a large portion of the cyst wall may be excised, laying bare the interior of the sac, which, with the vagina, should, after thorough antiseptic cleansing, be tamponed with sterile or iodoform gauze. This will need removal from time to time until the wound surfaces are healed.

Tuberculosis of the vagina is rather rare in occurrence and usually secondary to disease of some other organ or organs, as the Fallopian tube, the uterus, bladder, or rectum. It occurs in the form of miliary tubercles, about the size of a millet-seed, which undergo caseation, break down, and form ulcers covered with caseous pus. These ulcers are slightly depressed, irregular in shape, and surrounded by a reddish ring formed by miliary tubercles.

Treatment consists in *excision* of the diseased tissue, followed by cauterization of the base of the ulcer.

Stenosis, or narrowing of the lumen of the vagina, the result of cicatricial contraction following upon ulcerative processes from whatever cause, may necessitate removal of the scar tissue and suture of the resulting wounds. After union is obtained vaginal dilators may be used until the danger of a recurrence of the contraction is past.

Neoplasms of the Vagina.—*Fibrous* or *fibromyomatous tumors* are probably the only benign growths found in the vagina. These tumors may be situated in the vaginal walls in the same way that vaginal cysts are, or they may become pedunculated (Fig. 182).

The symptoms produced by them are very similar to those caused by the presence of cysts. They are non-elastic, and on aspiration no fluid is obtained from them. When polypoid in form and extruded from the vulva they are apt to become

ulcerated by the rubbing of their surfaces in walking. When the capsule undergoes necrosis, ill-smelling discharges result, with accompanying irritation of the surrounding parts.

Intramural tumors are best enucleated by making a linear incision through the vaginal wall over the tumor. After the hemorrhage has been controlled the edges of the wound are brought together by sutures.

Polypoid growths may be amputated, bleeding vessels controlled, and the base sutured.

Papillary excrescences of non-malignant character are sometimes found on the vaginal mucous membrane, usually in conjunction with an acute vaginitis. They are formed by a proliferation of connective tissue and epithelium. The only symptoms of discomfort to which they give rise are the irritating and often offensive discharges. Sometimes they cause profuse bleeding. They are best treated by excision and union of the wound edges by suture; or curetment may be employed with the application of a strong astringent or caustic to the base. The accompanying vaginitis should be treated according to the usual methods.

The *malignant neoplasms* found in the vagina are sarcoma and carcinoma.

Sarcomata of the vagina are of infrequent occurrence. H. A. Kelly classifies them, after the method of Steintal and Kolisko, into two classes, one occurring in adults and the other in young children.

In adults the tumor is usually a diffuse growth and resembles a fibromyoma. As it enlarges the surface ulcerates and resembles a papillary growth; foul discharges result, and sometimes slight hemorrhages. Necrosis of the tumor soon causes septic infection and death.

In young children sarcoma appears as a tumor polypoid in form and usually found on the anterior vaginal wall (Veit). It commences as a berry-like tumor in the connective tissue of the vulvar cleft and spreads rapidly over the vaginal wall, extending to the bladder and the cervix uteri. It finally infiltrates the pelvic organs and connective tissue throughout. Offensive sanious discharges accompany the breaking down of the masses and induce fatal sepsis. The diagnosis is



FIG. 182.—FIBROMA OF ANTERIOR VAGINAL WALL.

made by the microscope. The prognosis is bad. But few permanent recoveries have been reported.

Early *excision* is indicated. When the disease extends into the connective tissue, the thermocautery should be used over the surface from which the tumor has been excised.

Carcinoma of the Vagina.—This affection of the vagina is usually secondary, being an extension, as a rule, of the disease from the cervix or vaginal vault. Primary cancer may occur, and usually in the form of fungous masses of tissue on the posterior vaginal wall. Sometimes it occurs as a granulating ulcer with hard, infiltrated margins, and more rarely we have simply infiltration of the vaginal walls with rigidity and contraction.

The *earliest symptom* is a thin, irritating, watery discharge from the vagina. Later, hemorrhages occur; there is dull pain and sometimes disturbance of the action of bowels and bladder. Cachexia becomes marked in the later stages of the disease, with the involvement of the lymph-channels, and the patient dies of exhaustion.

The disease usually appears after the fortieth year. It has been found in children. A microscopic examination of the tissues is often necessary to differentiate between this and sarcoma.

Treatment.—When possible the diseased tissue should be extirpated with as much of the connective tissue beneath it as possible, and the wound should be cauterized with the thermocautery. When it is not possible to remove the entire growth, because of the depth of the involvement, the surface may be curetted and some stimulating astringent application, as tincture of the chlorid of iron, applied about once a week. Astringent and antiseptic douches, as of alum or permanganate of potassium, will prevent odor, control hemorrhage, and prevent septic absorption. Schultze and Vulliet have advised the hypodermic injection every day or two of 10 to 12 drops of pure alcohol into the infiltrated area around the growth in inoperable cases. This has been thought to retard the development of the disease.

In cases otherwise favorable, it is proper to excise the entire thickness of the recto-vaginal or the vesicovaginal septum, if this procedure promises to eradicate the growth. The resulting fistula should be closed in the usual manner.

CHAPTER VI.

PLASTIC OPERATIONS ON THE PERINEUM, VAGINA, AND CERVIX; CURETAGE OF THE UTERUS, AND INVERSION OF THE UTERUS.

BY CHARLES P. NOBLE, M.D.

THE GENERAL PRINCIPLES INVOLVED IN PLASTIC OPERATIONS UPON THE UTEROVAGINAL CANAL.

All plastic operations about the vulva, vaginal outlet, vagina, cervix, and uterus have many details in common which may be considered profitably before taking up the individual operations.

Preparation for Operation.—The general principles discussed under the "Preparatory Treatment for Celiotomy" (page 503) are equally applicable to plastic operations upon the uterovaginal canal, and the reader is referred to that chapter for this information. Only the questions peculiar to plastic operations upon the uterovaginal canal will be discussed.

In operations for complete rupture of the rectovaginal septum (complete tear of the perineum) particular attention should be given to the emptying of the alimentary canal, especially when constipation has been present. Should this not be thoroughly carried out, the passage of scybalous masses some days after operation might well tear open the recently united ends of the sphincter ani muscle. No purgative is so satisfactory for this purpose as castor oil, which should be administered on alternate days several times before the operation. Compound licorice powder and Epsom and Rochelle salts are also eligible preparations.

The two days' confinement in the hospital or restriction in a private house, recommended for celiotomy cases, is quite sufficient for plastic operations. An exception to this rule is cases of extreme procidentia, especially when erosions or actual ulcerations exist about the cervix. In all cases of complete procidentia it is desirable to have the patient remain in bed and to have the parts kept in place with tampons for several days. When ulceration is present, this is especially important, and the ulcers should be treated with applications of nitrate of silver in addition to the tampons until they are healed; otherwise the surgeon takes the risk of infecting the vaginal and perineal wounds. Another exception is when suppurative inflammation of any of the mucous membranes is present. Under such conditions plastic operations should be postponed until the local suppuration has been cured.

On the morning of operation the patient's lower bowel is washed out with a simple enema. After her bowels have been moved, the vulvar region, the skin as far back as the coccyx, and the inside of the thighs are scrubbed by the nurse

with gauze, soap, and water. The labia are then shaved, and in case an abdominal operation is to be done, the pubic hair is shaved at the same time. The parts are then rinsed with sterile water, after which a vaginal douche of two quarts of formaldehyd solution 1 : 4000 (or bichlorid solution 1 : 2000) is given. The external genitals and the inside of the thighs are then washed with the above solution and dried with a sterile towel. A large sterile vulvar pad of gauze and cotton is applied, the ends being fastened to an abdominal band.

No food is given the morning of the operation. If the operation is to be performed in the afternoon, clear broth or coffee may be given in the morning. The patient is catheterized immediately before the operation. If curetage alone is to be performed, it is unnecessary to shave the patient. For all other operations it is desirable.

Operation.—Almost all operations upon the uterovaginal canal are most conveniently performed with the patient in the lithotomy position. In exceptional cases, more especially for the closure of vesicovaginal fistulæ, Sims' position or the knee-chest posture is preferable. The standard operating tables are of convenient height. If the operation is done in a private house, one of similar height should be selected. The standard operating tables (Boldt, Baldwin) are supplied with leg-holders. Those to which the feet are attached (Edebohls' pattern) are the most desirable, as they do not interfere with the circulation in the legs. Portable Edebohls leg-holders should be a part of the surgeon's kit when operating in private houses. The operating table is covered with a sterilized pad, and upon this, at the end of the table upon which the buttocks are to rest, is placed a Kelly rubber perineal cushion. The buttocks rest securely upon the cushion, projecting slightly over the edge of the table. The thighs are flexed upon the abdomen and the legs upon the thighs, the feet being held by the leg-holders. Before the patient is put upon the table, long, loose, sterilized canton flannel stockings are drawn over the patient's legs. They should be long enough to extend well up the thighs. The arms of the patient are folded across her chest and retained in this position by pinning the sleeves of her gown and by drawing the skirt of the undervest well up over the elbows. If the arms are allowed to hang over the edges of the table, pressure palsy may develop. The nightgown is pushed up under the small of the back above the drainage cushion. The external genitals are again washed with soap and water, the official green soap, to which enough water has been added to make it liquid, being the best for this purpose. The vagina is then thoroughly washed out by filling it with the liquid soap and scrubbing it with cotton held in the fingers or with a forceps and douching with water. When operations are done upon virgins, forceps should be used and care taken not to rupture the hymen. The vagina and external genitals are then douched with formaldehyd solution 1 : 4000 (or bichlorid solution 1 : 2000). A thorough cleansing of the vagina and external genitals will require from three to five minutes. The legs of the patient and the lower abdomen are then covered by wrapping each leg separately with a sterile sheet. A sheet in which a central slit has been made is then placed between the

thighs to cover the lower abdomen and the perineal region. Through the opening the operation is performed.

Assistants.—For convenience and rapid work three assistants are necessary—one to give the anesthetic, and one to stand on each side of the patient to help the operator. A fourth will be required if the operator does not reach his own instruments.

Irrigation.—Irrigation by a continuous stream of warm water directed over the field of operation is the best means of removing the blood, leaving the field of operation constantly under the eye of the surgeon. Blood can be removed by sponging either with gauze or marine sponges, but this process requires an additional amount of time and in general it is less satisfactory. A reservoir which can be sterilized by boiling and which holds at least two gallons of water should be suspended at an elevation of five feet above the operating table. The water is conducted through a rubber tube to the field of operation. The flow may be regulated by a glass douche nozzle and a hard-rubber stop-cock, or by means of the Swedish hard-rubber ball-and-socket nozzle, or by means of the screw shut-off used by Ill, of Newark (Figs. 183, 184). The assistant to the right of the patient takes charge of the irrigation, and keeps the field of operation free from blood. The assistant to the left of the patient threads the sutures through the carriers or directly into the needles, as may be preferred by the surgeon.



FIG. 183.—SWEDISH HARD-RUBBER BALL-AND-SOCKET NOZZLE FOR IRRIGATOR.



FIG. 184.—ILL'S SCREW SHUT-OFF FOR IRRIGATOR.

The surgeon may outline with a scalpel the area of denudation in the various operations before removing the tissues with scissors. This is especially important for the beginner. For most plastic operations, with increasing experience, the surgeon is enabled to gage the outlines of the operation without the preliminary incisions. Bleeding is seldom an important factor in plastic operations. At times small arteries spurt. They should be caught with artery forceps; but if these are in the way of the operation, they may be tied with light-weight catgut ligatures. What is more troublesome is venous oozing when the vaginal plexuses of veins are opened. Venous oozing is usually best controlled by passing sutures under the bleeding area. Small arteries may be controlled in the same way.

Suture Materials.—The suture materials for plastic surgery consist of silk, silkworm-gut, catgut, and silver wire. Silkworm-gut sutures have largely taken the place of silver wire. Both are excellent suture material for non-absorbable sutures which must stand tension. Catgut, plain or chromicized, is used to approxi-

mate surfaces when tension is not a factor. Catgut has the advantage that it does not require subsequent removal, a very important quality in sutures for the cervix, the anterior vaginal wall, and for the upper vaginal sutures in perineorrhaphy when a series of plastic operations are performed at one sitting. Aside from the discomfort to the patient and the loss of time of the surgeon in removing non-absorbable sutures under these circumstances, a freshly united perineum may be damaged in removing sutures from the cervix or anterior vaginal wall. Fine silk and fine catgut sutures are used for accurate approximation. Silk is used to make carriers with which to introduce the various sutures.

Dressings after the Operation.—At the end of the operation the vagina and external genitals are douched to remove blood or blood-stains. By pressure against the perineum and hypogastrium any water is forced out of the vagina. A small strip of plain gauze is then inserted into the lower half of the vagina to act as a drain, and also as a guide to the nurse in catheterization. The gauze is removed at the end of two days. The vulva is protected by a sterilized gauze or cotton pad attached to an abdominal bandage. Because of the difficulty in sterilizing the ordinary T-bandage, it has been abandoned, and the vulvar pad is made to take its place; the ends of the pad being attached to an abdominal band.

Formerly it was customary to use powders on perineal wounds. An application of sterile boric acid is made to the fresh wound before the patient leaves the operating room, but thereafter no powders are employed. Probably as good results would be obtained if the boric acid were omitted.

The patient is dried with a towel before she leaves the operating table. She is then placed on a stretcher and well covered with blankets for transportation to her bed. It is a good rule to send a doctor with the patient from the operating room to see her carefully placed in bed and that her condition is satisfactory. A nurse or doctor should remain with every patient until she fully recovers consciousness. If this duty is entrusted to a nurse, one of experience should be selected, so that she will recognize dangerous symptoms should they arise. In rectal or perineal operations it is unnecessary to restrict the movements of the legs after the patient becomes conscious, as was formerly the practice. The patient may be turned on her side if she wishes, but in general patients are more comfortable if they are not permitted to toss or roll about.

After perineal operations the bedpan must be used for two weeks, and straining at stool should be avoided. After cervical operations a stay in bed of from seven to ten days is sufficient. The patient should be encouraged to void her urine voluntarily from the first in cervical operations. After perineal operations the catheter is used every six or eight hours for two days. After curetage it is better to allow a patient to sit up in bed for urination rather than to use a catheter.

The external genitals are douched with formaldehyd solution (1: 4000) after urination or defecation, and at least four times in twenty-four hours. After the second day a daily douche of two quarts of formaldehyd solution (1: 4000) is given. Some surgeons prefer to omit this douche unless a vaginal discharge

appears. The nurse should use an aseptic technic and should be instructed to insert the douche nozzle along the anterior or antero-lateral vaginal wall, in perineal operations, and to use all due gentleness so as not to disturb the line of union. A rough, awkward nurse has been known to thrust the douche nozzle through a recently repaired perineum.

Catheterization.—Whenever catheterization is required there is a definite risk of causing cystitis. This is especially true when the catheter is used after operations upon the pelvic organs which interfere with the circulation of the bladder. Cystitis is most apt to occur in feeble patients and those having had extensive operations involving the bladder walls, such as hysterectomy for cancer. Nurses should be taught an exact aseptic technic for catheterization in order to minimize the risk of causing cystitis, but experience has demonstrated that cystitis will occur after catheterization in a considerable percentage of cases, no matter how rigid the technic employed. The following is the technic for catheterization in use in the Kensington Hospital for Women:

The nurse shall place in a sterile basin a dressing forceps, cotton balls, a bunch of cotton, and a glass catheter, and add enough sterile water to cover the same. This shall be boiled over the gas flame (or in a water-bath) for ten minutes. She shall then disinfect her hands by scrubbing them for three minutes with soap, water, and a sterile nail-brush. The finger-nails are then cleansed with a sterile wooden nail cleaner, and the hands again scrubbed for three more minutes. The hands are then soaked in formaldehyd solution (1 : 500) for two minutes. The nurse shall then cool the boiling water in the basin by adding cold sterile water. She shall then assemble and take to the patient's bed the things necessary for catheterization: the above basin and apparatus which has been boiled, a sterile basin containing formaldehyd solution 1 : 4000, a sterile basin containing formaldehyd solution 1 : 500, a sterile basin or other sterile urinal to receive the urine, a sterile basin containing sterile water, a sterile vulvar pad when needed, dry sterile cotton, a sterile towel, a night candle or movable electric light, and a small bottle of sterile liquid soap. She shall then place the patient in position for catheterization, and cover her legs properly with a sheet, exposing the vulvar region. She shall then remove the vulvar pad, if present. She shall then wash her hands with sterile soap and sterile water, and dry them with a sterile towel. She shall then soak her hands for two minutes in formaldehyd solution (1 : 500). The nurse shall then separate the labia with the thumb and index-finger of her left hand, the tips of which shall be wrapped in cotton squeezed out of formaldehyd solution (1 : 4000). She shall then wash the vulva and region of the urethra with formaldehyd solution (1 : 4000) with a bunch of cotton held in her right hand. She shall then wash the urethral orifice with formaldehyd solution (1 : 4000), using cotton balls held in the dressing forceps, during this time keeping the labia well separated. She shall then take the catheter from the basin in which it has been boiled, grasping it by the extreme outer end (taking care not to touch it anywhere else), and pass it gently through the urethra into the bladder. The urine shall be received in a

sterile basin or urinal. When the urine ceases to run, the nurse, holding the catheter between the index and middle fingers, shall place her thumb over the end of the catheter, so that when the catheter is drawn the urine shall not dribble over the perineum. Care shall be taken to withdraw the catheter gently, lest the urethral or bladder mucous membrane be caught in the eyes of the catheter. Should it be evident that the catheter is caught, the thumb shall be removed from the end of the catheter and the catheter gently rotated or pushed further into the bladder, all care being taken in these manipulations. When the catheter is free, the thumb shall be placed again over the end of the catheter and the catheter withdrawn gently. The nurse shall again wash the urethral region and perineum with cotton and formaldehyd solution (1 : 4000) and dry the vulva with dry cotton. In cases requiring it, a sterile vulvar pad shall now be applied. Time will be saved if two nurses are employed instead of one. One can boil the apparatus and assemble the necessary materials and place the patient in position while the other disinfects her hands. The non-sterile (assistant) nurse shall remove the vulvar pad, if present, taking care not to touch the patient. In this case it will be sufficient for the non-sterile (assistant) nurse to wash her hands thoroughly with soap and water and a brush for three minutes after placing the apparatus on the gas flame to boil and before assembling the materials needed for catheterization. When two nurses are employed, the basin of sterile water, the basin of formaldehyd solution (1 : 500), and the bottle of sterile liquid soap need not be assembled. When two nurses are employed, the sterile nurse shall take care to touch nothing which is not sterile, and the non-sterile (assistant) nurse shall take care not to touch the inside of any of the sterile apparatus, and not to infect the patient by touching her. After use, the catheter shall be washed and placed in a jar of formaldehyd solution (1 : 500), which solution shall be changed daily. The forceps shall be cleansed and wiped dry, and put with other instruments for sterilization.

The rubber catheter possesses the advantage that it is less apt to cause trauma of the urethra and bladder. In the case of impacted tumors at times the use of the rubber catheter is essential, as the glass catheter cannot be made to enter the bladder with safety.

Care of the Bowels.—On the afternoon of the day following the operation 1 or 2 grs. of calomel should be administered in divided doses, followed the next morning by citrate of magnesia solution, Epsom salts, or Seidlitz powders, and if necessary later by an enema. A convenient formula is a concentrated preparation of solution of citrate of magnesia, 4 oz. of which is equivalent in strength to the usual bottle of citrate of magnesia solution. This may be given in doses of 1 to 2 oz. until the bowels are moved. The following is a favorite formula for the administration of Epsom salts: *Magnesii sulph. ʒij, acid. sulphur. aromat. ꝑv, syr. zingiberis f ʒij, aquæ f ʒij.* This amount, or double the amount, may be given every two or three hours until the bowels move. If the stomach is intolerant, such pills as pill cascara cathartic comp., or pill aloin, strychnin, and belladonna, may be given, every three hours instead of the solution. Castor oil, when the stomach is tolerant,

is probably the most efficient purgative. The action of the purgative may be hastened by the administration of a soapsuds enema containing 1 to 4 drams of turpentine. When the bowels are once thoroughly opened, they should be moved daily by means of mild laxatives, assisted if necessary by enemas.

Diet.—No food is given until the patient desires it. After from twelve to twenty-four hours the patient will usually take small amounts of liquid diet. Albumin water, broth, clear tea, coffee, or milk, are usually well borne at this time. From the third to the tenth day light soft diet is best. When the patient's appetite demands it, full diet may be given. An exception to this rule should be made in complete rupture of the perineum. In such cases the diet is limited for at least a week to those substances which do not leave a residuum in the bowels, such as albumin water, strained broth, fruit juices, tea and coffee.

Care of the Wound.—The aseptic care of plastic wounds is a part of the training of all well-regulated training schools for nurses. The principles involved are that all objects capable of conveying infection shall be kept from contact with the wound. Neither the surgeon nor the nurse shall touch the wound with the hands in subsequent dressings. Discharges are removed by irrigation or by means of cotton and sterilized forceps. The nurse must never dress the wound without first disinfecting her hands. The nurse must be taught to separate the labia without making undue tension upon the sutures.

The question of irrigation of the wound and vaginal douches has already been discussed.

The Relation of Hospital Apparatus and the Technic of Nurses to the Infection of Wounds.—Infection from the nurse's hands of the field of operation, of the region of the urethra in catheterization, and of wounds more especially in plastic operations, has happened very frequently in the past, and is a matter of such importance that it should receive more attention on the part of those in charge of hospitals than is the case. The fact is well known that it is impossible to disinfect the hands by any known means when they are infected with virulent microorganisms until at least two days have elapsed. This was taught surgeons by the many cases of septic peritonitis which followed a failure to observe this rule before the introduction of rubber gloves. The same is true of the hands of nurses, and yet, until the present time, no adequate precautions have been taken to meet this situation. Surgeons have learned to avoid trouble by keeping their hands away from septic matter. Dirty dressings are made by others, and rubber gloves are worn by the surgeon to prevent his skin from coming in contact with septic matter. On the other hand, the nurse constantly handles septic objects, and therefore her hands presumably are constantly infected.

The chief sources of contamination of nurses' hands are the handling of bedpans and douche-pans, which in most hospitals are either not disinfected at all or else very inadequately; the handling of septic dressings in carrying them from the patient to the cans in which they are collected; the handling of objects in the wards

and the rooms of the patients upon which disease germs settle. In the Kensington Hospital for Women, to meet this situation, a sterilizer in which douche-pans and

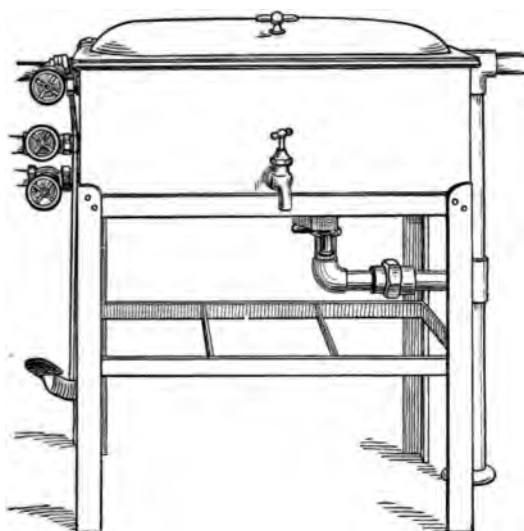


FIG. 185.—INSTRUMENT STERILIZER.

bedpans can be boiled by means of high-pressure steam has been installed upon each floor, and these articles are disinfected at least once every day.¹ Also in each diet kitchen an instrument sterilizer has been installed similar to those used in operating rooms, so that the apparatus of the nurses can be sterilized as adequately as that used by the surgeon (Figs. 185, 186). In addition, regulations are in force that bedsteads, the tops of articles of furniture, and the door-knobs, the rooms and shelves in which the apparatus of the nurses is stored, are disinfected every day by washing the same with formaldehyd solution;

and in the toilet rooms sterile nail-brushes and wooden nail cleaners are provided, with proper regulations for the mechanical cleansing and disinfection of the nurses' hands. By these means, together with a rigid disinfection of bath-tubs before patients

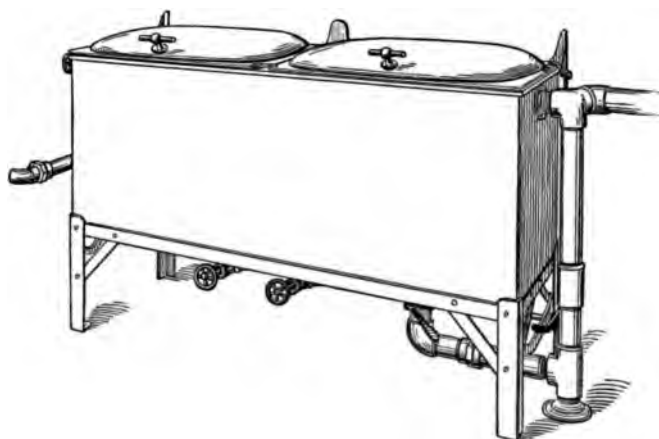


FIG. 186.—BEDPAN AND DOUCHE-PAN STERILIZER.

are bathed in them, it is sought to prevent the conveyance of infection by way of the nurses' hands to the field of operation, to the urinary tract, and to wounds of patients.

¹ Noble, Charles P.: "The Relation of the Technic of Nurses and of Hospital Apparatus to the Healing of Wounds," *Annals of Surgery*, 1906, vol. xlv, p. 431.

Some Useful Instruments for Plastic Surgery.—Certain instruments useful in plastic surgery not shown elsewhere will be illustrated here. Fig. 187 illustrates the Reiner needle-holder as modified by the author. This instrument is so satisfactory that I have named it the "perfect needle-holder."¹ The original Reiner was so modified that the handle fits a man's hand comfortably and the beak of the instrument is so tapered that it will hold either light or heavy needles without breaking. For the use of curved needles it leaves little to be desired. Fig. 188 illustrates a forceps with a slide catch which has been so long upon the market that the name of its inventor is forgotten. This forceps is most useful in removing sutures, especially from the uterovaginal tract, and also in making dressings and removing packing. Fig. 189 illustrates Bozeman's sigmoid curved uterine scissors. These scissors are useful for plastic operations upon the vagina, especially vesicovaginal fistulæ, and

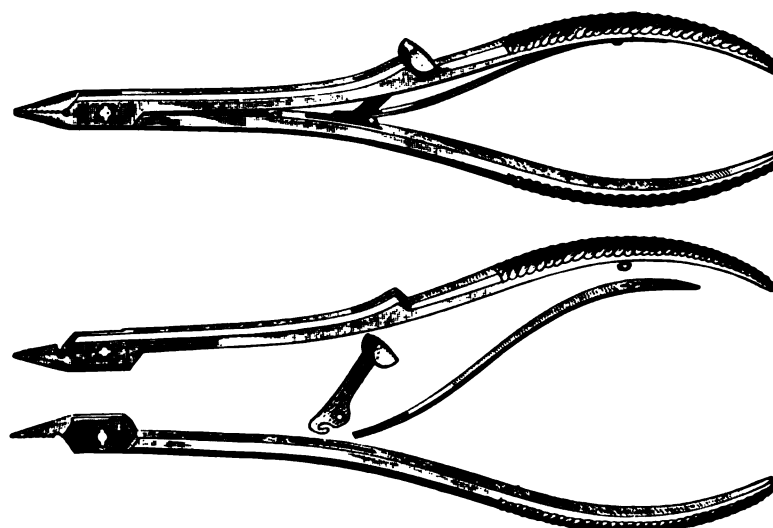


FIG. 187.—THE PERFECT NEEDLE-HOLDER.
Noble's modification of the Reiner needle-holder.

for the removal of sutures. They are most useful for opening through the posterior culdesac into Douglas' pouch when vaginal drainage is indicated either after abdominal operations or in the treatment of pelvic abscess. Fig. 190 illustrates Sims' blunt-pointed uterine scissors. This instrument has the same uses as Bozeman's model, but the sigmoid curve of the latter frequently adds to its usefulness. A special size of the Sims speculum is practically indispensable for the removal of sutures from the vagina. The dimensions of the blade should be as follows: The large blade should be 9 cm. in length and 2 cm. in breadth: the small blade should be 8 cm. in length and 1 cm. 4 mm. in breadth.

Removal of Sutures.—External sutures may be removed from the perineum at the end of one week. It is best to remove such sutures as are cutting. In case of

¹ Noble, Charles P.: "The Perfect Needle-holder," *Ann. Gyn. and Pædiat.*, March, 1894.

infection the sutures may require removal at any time. The vaginal sutures in perineal operations may be removed from the twelfth to the fourteenth day. In complete rupture of the perineum, if the sutures are not cutting, those through the sphincter muscle should not be removed before the tenth day. If silkworm-gut sutures are used in the cervix or anterior vaginal wall, they may remain in place almost indefinitely; and, if a series of operations has been done, they should not be removed earlier than three or four weeks following the operation, in order to permit of sound healing of the perineum.

The superficial silk suture or sutures in the ordinary perineal wound may be removed without changing the position of the patient, but for sphincter tear operations or for the removal of vaginal sutures the patient should be placed across the bed or on a convenient table in a good light. If the natural light is insufficient, a movable electric light with reflector should be employed. A vaginal douche should be given immediately before removing the sutures, in order that the parts may be



FIG. 188.—SLIDE CATCH DRESSING FORCEPS.

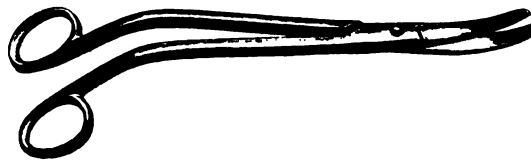


FIG. 189.—BOZEMAN'S SIGMOID CURVED UTERINE SCISSORS.



FIG. 190.—SIMS' BLUNT-POINTED UTERINE SCISSORS.

free from discharges. The patient should be in the lithotomy position, with the thighs flexed on the abdomen and the knees supported by a nurse. A special small-sized Sims speculum is inserted under the anterior vaginal wall. No attempt should be made to expose the entire line of suture, but merely to expose one suture at a time. The lowest suture is caught up with forceps and drawn upon until the knot is exposed. One blade of the scissors is slipped under the loop of suture and it is cut at one side of the knot and withdrawn. Counter-pressure may be made with the flat side of the scissors when the suture is drawn upon. By exposing one suture at a time there is usually but little trouble in removing them. Touch affords more certain evidence than vision that all of the sutures have been removed.

In removing sutures from the rectum in complete sphincter tear operations, the patient should be put in the Sims position. A narrow special Sims speculum may be inserted into the anus and the sutures removed in the same manner as de-

scribed for vaginal sutures. At times this is unnecessary, as the rectal sutures are very superficial and not infrequently they have become loosened by the tenth or twelfth day and can be removed by gentle traction without cutting the loop. In other cases slight traction exposes the loop without the use of the speculum. It is essential to avoid undue traction on the sphincter with the speculum.

Care must be taken in removing sutures not to cut off both sides of the loop below the knot, as a suture thus left in the tissues will invariably cause irritation and sooner or later a sinus, which will persist until the suture itself is removed.

Rest and Tonic Treatment.—For a simple curetage it is sufficient to have the patient remain in bed from five to seven days. By this time the process of restoration of the endometrium is well advanced. The patient may be discharged two or three days after she leaves her bed, with instructions to avoid active exercise for a week.

After operations upon the cervix the patient should remain in bed from a week to ten days, and should avoid active exercise for at least another week.

After perineal operations, especially those involving the levator ani muscle and the pelvic fasciæ, in which there is loss of support of the pelvic viscera, the patient should remain in bed at least two weeks, and in cases of procidentia in which a series of operations have been done a longer stay in bed is preferable. Such a patient should be advised to keep off her feet and to avoid lifting or straining for several weeks after leaving her bed, as wounds do not become solidified for at least eight or ten weeks. The percentage of failure to cure hernia of the pelvic contents will be increased or diminished, after well-performed operations, as this practice is adopted or neglected. The tendency of hospitals is to make the stay of poor patients too short and to hurry them home to make room for other patients. This is unfortunate so far as the result of the operation itself is concerned, and also as neglecting an opportunity for tonic and supporting treatment which so many hospital patients require.

Special care is needed after operations for complete rupture of the perineum until sound healing of the sphincter has been obtained. A laxative, such as castor oil, compound licorice powder, or sulphur, should be prescribed for several weeks in order to secure one or two soft stools daily until all danger of overstretching the new cicatrix has passed.

When neurasthenia and nervousness are prominent complications, the post-operative period is the most convenient time to institute curative treatment. The typical or modified rest cure should be prescribed and every effort should be made through the patient's family to relieve her mind of responsibility and anxiety.

As a general rule, sexual relations should be prohibited for ten weeks after plastic operations involving the perineum.

Hemorrhage Following Operation.—Hemorrhage following plastic operations upon the uterovaginal canal is a rare accident. In my experience it has usually come from the endometrium, once from a vessel in the cervix, and a few times from a vessel in the perineum. The most alarming hemorrhage coming under my obser-

vation followed a curetage of the cervix. The curetage loosened without removing a small polyp, and during the succeeding night an almost fatal hemorrhage occurred. It was arrested by firm packing. Packing of the upper vagina has sufficed to control all hemorrhages after plastic operations coming under my observation, with one exception. In one case it was necessary to resuture the cervix.

In case of hemorrhage the patient is put arcross the bed or on a table in the lithotomy position with a good light on the parts. The vagina is washed free from clots. A narrow-bladed Sims speculum is then introduced to elevate the anterior vaginal wall, and a search is made for the bleeding point by cleansing the wound with cotton pledgets. If the bleeding point is found, it should be secured by passing a suture to control the flow. If the blood comes from the uterus, a tampon of sterilized cotton, preferably non-absorbent, should be tried, to make pressure upon the cervix and upper vagina. Should this not control the bleeding, the cervix must be exposed even at the expense of injuring the perineal operation. A tight pack in the upper vagina, carefully applied, does not often interfere with the union of the parts.

Infection.—The symptoms of infection following plastic operations upon the uterovaginal canal are like those from an infected wound elsewhere. Infection following plastic operations is a rare accident and occurs in probably less than 1 per cent. of the cases. The symptoms usually appear in about a week, occasionally as early as the third day. Fever is usually present and there is more or less pain. In the stage of exudation, hot packs of sterile boric acid solution or formaldehyd solution (1 : 10,000) should be frequently applied to act as a poultice. If the suture tracks are infected, the sutures should be removed. As soon as pus has formed it should be evacuated, and if an error is made it should be upon the side of early incision. Early incision will forestall the infiltration of the wound with pus and will often prevent the failure of an operation. The incision may be made through the ischiorectal fossa, the perineum, or the vaginal wall, depending on the location of the exudate.

A rare accident is an abscess of one of Bartholin's glands, the exciting cause of which being the traumatism of the operation. In this case an incision should be made directly into the abscess cavity as far away as feasible from the field of operation.

Diffuse phlegmonous inflammation may follow infection of the perineum, leading to septicemia and death. Three such cases have come under my observation—one in consultation practice, two in my own work. In the first case phlegmonous inflammation followed the removal of a cyst of Bartholin's gland. The patient died of septicemia and septic pleurisy. In my own cases the first died of septicemia and septic pleurisy, the second of septicemia.

Free incision of the abscess, free douching, and careful attention to the granulating wound, often give a surprisingly good result when infection of the perineal wound has occurred.

DILATATION OF THE CERVIX UTERI.

By dilatation of the cervix uteri is meant the artificial increase of its caliber by means of instruments.

The cervix is usually dilated by means of metallic branched dilators, working more or less upon the principle of the glove-stretcher; and this type of dilatation is that which will be described in detail. The cervix is dilated also by means of grad-

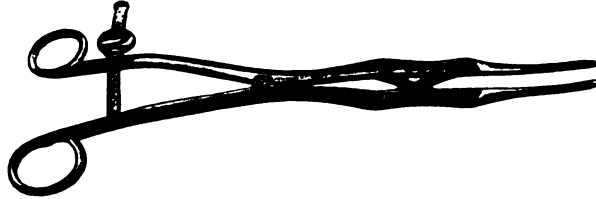


FIG. 191.—ELLINGER DILATOR.

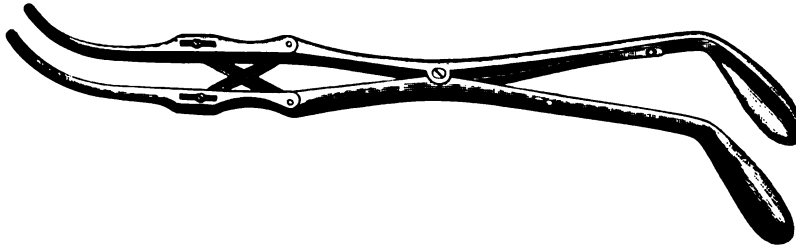


FIG. 192.—GOODELL LIGHT UTERINE DILATOR.

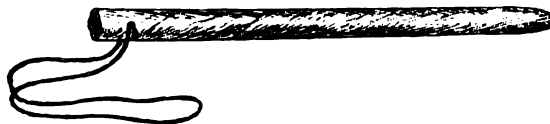


FIG. 193.—LAMINARIA TENT.

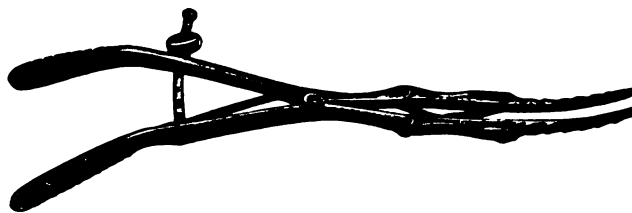


FIG. 194.—GOODELL HEAVY UTERINE DILATOR.

uated sounds used in the same manner that urethral sounds are employed to dilate a stricture of the urethra. As in my judgment this method of dilatation possesses no advantages over rapid dilatation by means of branched dilators, and, on the contrary, is more apt to result in perforation of the uterus, it will not be described further.

Various forms of tents made of sponge, laminaria, tupelo, and slippery elm, were employed largely in former years. In the preantiseptic era the use of such tents

was followed frequently by metropéritonitis, and as a result the practice fell into disfavor. Tents have been employed by various authorities of recent years (among others by Montgomery), and those who have used them claim that the former bad results attributed to the use of tents were really due to the lack of asepsis prevalent at the time this practice was in vogue. Laminaria and tupelo tents are recommended

especially in those cases in which it is desired to dilate the cervix sufficiently to introduce the finger and to palpate the interior of the uterus (Fig. 193).



In addition to the branched dilators of the Ellinger type (Fig. 191) or of this type as modified by Goodell (Figs. 192, 194), in which rapid dilatation is secured by compressing the handles of the instrument manually, or by means of a screw attachment, another type of metallic dilator has been introduced by Schatz, called a "metranoikter," in which the dilating force is supplied through the action of a spring. The instrument of Schatz has two branches. Hirst has modified the instrument (Fig. 195) so that it has three branches. This instrument can be employed under the same conditions

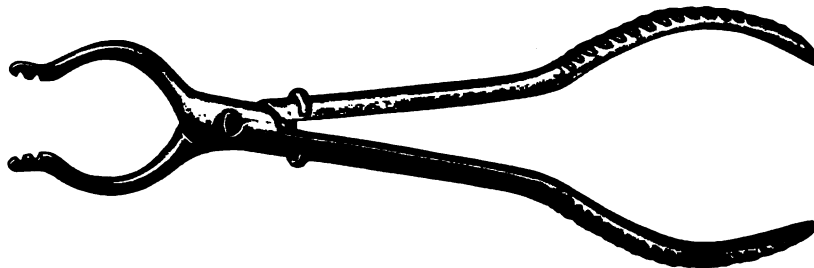


FIG. 195.—HIRST-SCHATZ METRANOIKTER.

for which the usual dilators are employed, more especially when full dilatation is desired; as, for example, when dilatation is used as a preliminary to the palpation of the interior of the uterus. According to Norris, one of the most, if not *the* most, useful applications of the instrument is in the treatment of incomplete abortion. He states that when abortion is incomplete and the cervix but slightly dilated, so that the manual removal of the decidua or of the placenta is difficult or impos-

sible, if the metranoikter is introduced under full aseptic precautions and allowed to remain for twelve hours, more or less, that as a result the cervix is widely dilated, so that one or more fingers can be introduced readily within the uterus and the retained placenta or secundines easily separated and removed. If this recommendation of Norris proves as satisfactory as it is logical, it will add greatly to the facilities of the trained practitioner in dealing with incomplete abortion.

Indications.—Dilatation of the cervix is indicated whenever it becomes necessary to explore the interior of the uterus, and in non-puerperal women when it is necessary to curet the uterus or to practise intrauterine irrigation. In puerperal cases it is indicated in incomplete abortions. Dilatation of the cervix is indicated for the cure of dysmenorrhea due to obstruction to the flow of menstrual blood; also as a preliminary step in curetage for the cure of dysmenorrhea when due to endometritis.

Contraindications.—The position of the uterus and the condition of the appendages should be determined before a dilatation is performed. The cervix should not be dilated in cases in which there is a pelvic peritonitis, an ectopic pregnancy, a pyosalpinx, or a pelvic abscess, unless the procedure is to be followed immediately by whatever operation may be necessary for the relief of the condition. Dilatation of the cervix should be done only under strict aseptic precautions, and should not be looked upon as a trifling procedure. The practice of dilating the cervix in the physician's office and allowing the patient to go about subsequently is reprehensible.

The preparation of the patient for operation is considered on page 347.

Operation.—The perineum and posterior vaginal wall, except in virgins, are retracted with an Edebohls self-retaining speculum (Fig. 196), thus exposing the cervix, which is grasped at the anterior lip with a pair of double tenaculum forceps (Fig. 29) and pulled down gently toward the vulva. In virgins the cervix is grasped with a pair of double tenaculum forceps guided by a finger introduced into the vagina, and pulled down to the vulva. A small Ellinger dilator is then introduced within the external os and passed gently up into the uterus. The dilator must never be pushed through obstructions, but manipulated gently by them, turning the point of the instrument in different directions until it will pass through the internal os. After moderate dilatation the Goodell corrugated dilator is introduced and the dilatation continued. In dilating the cervix pressure should be made in all directions, as is done in stretching the finger of a glove, and not merely from side to side.

Dilatation of the cervix is usually followed by curetage and irrigation of the cavity of the uterus. When curetage is not indicated, it is best to irrigate the



FIG. 196.—EDEBOHLS' SELF-RETAINING SPECULUM.

uterus or to wipe out its cavity with gauze. Irrigation of the uterus is best carried out by means of the Fritsch-Bozeman return-current intrauterine irrigator (Fig. 43).

After-treatment.—The patient remains in bed at least four days and is given a daily vaginal douche of two quarts of formaldehyd solution, 1 : 4000.

Prognosis.—Under typical conditions the operation is a safe one and should be followed by prompt recovery. It may be followed by a fatal termination. When this is the case, it is due either to perforation of the uterus, to infection due to lack of asepsis, or to faulty diagnosis, by which a septic focus preexisting in the pelvis is overlooked. (For a further consideration of these risks see section on the Prognosis of Curetage.)

I have never employed a tent for dilatation of the cervix, but would not hesitate to do so if I desired to palpate the interior of the uterus. The field of usefulness of the tent is limited to the class of cases in which the presence of a small submucous fibroid is suspected, or in which curetage has failed to arrest bleeding from the uterus, and when very exact knowledge as to the condition of the uterine mucosa is advisable. If used, the tents should be sterilized by the method of dry heat, and should be introduced under full antiseptic precautions.

The metranoikter can be used under the same conditions, and also in the treatment of incomplete abortion.¹

CURETAGE OF THE UTERUS.

By curetage of the uterus is meant the scraping of the uterine mucosa.

The curet was invented by Récamier. The first mention of the instrument is found in the "*Annales de Therapeutique*," 1846, vol. iv, p. 182, in a critical editorial review. Récamier probably invented the instrument about 1845.² Récamier's curet was a species of scoop. The sharp curet was introduced by J. Marion Sims.³ The dull curet was introduced by T. Gaillard Thomas.⁴ Numerous modifications of the sharp and of the dull curet have been made by various surgeons.

Indications.—The indications for curetage occur in two classes of cases—puerperal and non-puerperal. In puerperal cases the curet is used to remove retained secundines from an incomplete abortion, a miscarriage, or when pieces of membrane remain after labor; also in certain cases of puerperal sepsis and puerperal sapremia when a thorough cleansing and an effort at disinfection of the birth canal is called for. In non-puerperal cases curetage is performed to remove the uterine mucosa in endometritis and glandular hypertrophy; to secure pieces of

¹ Hirst, B. C.: "Text-book of Diseases of Women," 1905, pp. 39, 702.

² "Memoires sur les productions fibreuses et fongueuses intrautérines," *L'Union médicale*, 1850, vol. iv, Juin 1, p. 275.

³ Sims, J. Marion: "On a New Form of Curette for the Removal of Uterine Fungoid Granulations," *Trans. London Obstet. Soc.*, 1865, vol. vii, p. 72.

⁴ Thomas, T. Gaillard: "Diseases of Women," Phila., 1880, p. 350.

tissue for microscopic examination in suspected cases of carcinoma of the body of the uterus; to remove the suppurating mucosa and usually cancerous tissue in pyometra; to remove necrotic tissue from the carcinomatous uterus when the disease has advanced beyond the stage in which a hysterectomy is indicated; and in particular instances as a temporizing procedure to check hemorrhage due to a fibromyoma of the uterus associated with grave anemia, in order to permit the patient to recuperate before submitting her to a radical operation.

Retained Secundines.—A patient suffering from retained secundines gives a history of pregnancy of one or more months' duration, followed by a history of abortion or miscarriage. This is followed either by discomfort in the region of the uterus or by irregular discharges of blood from the uterus. Upon digital examination the external os is usually patulous, the cervix soft and enlarged, the body of the uterus enlarged, soft, and somewhat tender. If infection has taken place, the temperature may be slightly elevated or very high. In cases without infection the temperature is normal.

In emptying the uterus when pregnancy has advanced beyond the tenth week, the retained material should be separated from the walls of the uterus by the finger, and the curet should be used only for the purpose of removing softened decidua and shreds, or pieces of tissue already separated by the finger. These procedures should be carried out under the influence of general anesthesia. Great care and gentleness should be exercised in cureting a puerperal uterus, as the curet may easily perforate the wall of the organ, and in septic cases produce a general peritonitis.

The indiscriminate use of the curet in cases of puerperal infection has done much harm, especially in streptococcus infection. In this type of puerperal infection the curet has a very limited field. If the sharp curet is used vigorously and the underlying protecting layer of white blood-cells is broken up, fresh infection is invited and the prognosis of the disease rendered much worse. In this type of infection, if the curet is used at all, only the superficial necrotic tissue should be removed, and for this purpose a large dull curet should be employed.

(For a further consideration of the use of the curet in puerperal cases, the reader is referred to the chapter upon Operations for Puerperal Sepsis.)

Acute Endometritis.—Acute infection of the uterine mucosa is due to infection following abortion, miscarriage, or labor; gonorrheal infection; operative traumatism with infection; attempts at producing abortion; the use of tents; and the exanthemata.

Symptoms.—Pain, or more usually discomfort, in the region of the uterus referred to a suprapubic region and to the sacral region is usually present. Reflex disturbances of the bladder characterized by frequent micturition may be prominent symptoms. The temperature may be normal in non-puerperal and very high in puerperal cases. The discharge from the cervix is increased, becomes puriform, and is sometimes streaked with blood. Digital examination shows the external os more patulous than normal, the cervix enlarged and softened, and the body of the

uterus enlarged and tender. The diagnosis is made from the history and from the digital examination and inspection through the speculum.

The **treatment** of acute endometritis, as a rule, is general and medical in its character, and is considered elsewhere in this book under appropriate headings.

In puerperal cases the curet is employed with advantage to remove necrotic shreds, membranes, and putrid blood-clots, in conjunction with or preferably subsequent to the manual removal of foreign substances with the finger, in all cases in which the fingers can be introduced under general anesthesia. In puerperal infection due to the streptococcus curetage is contraindicated. The dull curet may be employed to remove necrotic shreds and decidua if care is taken not to break down the underlying layer of white blood-cells.

Acute endometritis due to gonorrhea, to infection following operations, to the use of tents, and to the exanthemata, should be treated medically. Curetage is contraindicated under each of these conditions.

Chronic Endometritis.—Authorities differ radically concerning the nature and frequency of chronic endometritis. Kelly and Cullen hold that chronic endometritis is a rare disease, basing their conclusions upon the results of the microscopic study of endometrial tissue removed with the curet in about one thousand cases. They divide endometritis into the acute and chronic forms and have no subclassification. They hold that what is commonly called endometritis is usually either hypertrophy of the mucosa, edema of the mucosa, or atrophy of the mucosa associated with senile involution of the uterus. Inflammation is often associated with retained secundines, but such cases are not diagnosed as endometritis. In the last forty reports upon cases diagnosed clinically as endometritis from the pathologic laboratory of the Kensington Hospital for Women the diagnoses returned were as follows:

Endometritis, glandular.....	20
“ interstitial.....	10
“ universalis (combined).....	1
“ polypoid.....	3
“ decidual.....	3
“ suppurative.....	2
“ tuberculous.....	1

Of these forty cases, twenty would be called glandular hypertrophy under the Johns Hopkins classification. The polypoid and decidual cases would also be classified otherwise. A reasonable classification of chronic endometritis is into the glandular, the interstitial, and the combined varieties. Tuberculosis of the endometrium may well be classified as a separate disease.

From the standpoint of etiology, gonorrheal and puerperal infections are the chief causes. Kelly holds that the reason chronic corporeal endometritis is rare is that the acute variety tends to spontaneous recovery. This is my own opinion, provided the Fallopian tubes escape infection, and provided also that the uterus is in its proper position, so that the pelvic circulation is not interfered with. On the

other hand, in the presence of infection of the Fallopian tubes and displacement of the uterus, with interference with the pelvic circulation, chronic corporeal endometritis tends to persist.

Chronic endometritis is a late stage of acute endometritis, and it is due to the same causes. It may be due also to passive congestion caused by malpositions of the uterus, tumors, or diseased adnexa. This statement would be controverted by those who hold that all inflammation is due to infection, and such cases would be classified by them as instances of hypertrophy and sclerosis of the endometrium. The relation of endometritis to polyps and the relation of senile atrophy to endometritis are questions which deserve further study.

Chronic cervical endometritis is a frequent disease. Its usual cause is gonorrhea, and it tends to persist until cured by the removal of the infected glands by curetage or amputation of the cervix.

Symptoms.—Chronic endometritis may give rise to pelvic pain or discomfort, backache, headache, or other disturbances of the nervous system, to menstrual disturbances, to leukorrhea, to more or less disturbance of the general health, and to sterility. Discharge from the corporeal endometrium is usually thin in character, while that from the cervix is apt to be thick and ropy. The color of the discharge depends upon the presence of pus and blood. Many women have a free leukorrheal discharge from the uterus which is not due to endometritis. This occurs especially in run-down women with poor nutrition and a poor circulation. The clinical diagnosis must be made from the symptoms, and will necessarily be a provisional diagnosis, to be corrected by the results of microscopic examination of the scrapings.

Treatment.—The most effectual treatment for chronic endometritis is curetage. Curetage is contraindicated when infection of the adnexa exists as a complication. Complications, such as diseased adnexa, displacement of the uterus, lacerations of the cervix and perineum, must receive appropriate treatment. Chronic cervical endometritis may be cured by curetage in the milder cases, but in those associated with marked cystic degeneration amputation is often necessary.

Glandular Hypertrophy of the Uterine Mucosa.—The cause of this condition is not known. It occurs not infrequently in virgins at or shortly after puberty, and may give rise to excessive menstrual bleeding. It occurs when the uterus is normal in size and position, as well as when malpositions and myomata exist. It is usually diagnosed clinically as endometritis. At times it causes an annoying leukorrhea, at other times menorrhagia. In such cases curetage should be performed.

Mucous Polypi.—A mucous polyp is a localized outgrowth of the uterine mucosa. The cause of this disease is unknown. Polypi may give rise to no symptoms or may cause leukorrheal discharge or uterine hemorrhage. Curetage is the appropriate treatment.

Pyometra.—In pyometra the curet is used after dilatation of the cervix and irrigation of the uterus to remove the suppurating mucosa and usually portions of cancerous tissue. Pyometra is almost invariably due to cancer. I have seen one

case of suppurating hematometra due to imperforate vagina and one case arising in an elderly woman who had worn a pessary without having it removed for eleven years. As a rule, the curet and irrigation are used in pyometra to get rid of the pus preliminary to hysterectomy for cancer.

Cancer of the Body of the Uterus.—Curetage is performed in this condition to secure pieces of tissue for microscopic examination; rarely to check hemorrhage, in order that the patient may recuperate before undergoing radical operation; and in cases when pyometra is present to eliminate the pus, in order that the field of operation may not be contaminated when the radical operation is performed at a subsequent sitting.

Cancer of the Cervix.—In cancer of the cervix



FIG. 197.—RÉCAMIER'S DOUBLE-ENDED CURET.



FIG. 198.—THOMAS' DULL CURET.



FIG. 199.—SIMS' ANGULAR SHARP CURET.

the curet is used to secure pieces of tissue for microscopic examination; to remove necrotic cancerous tissue in order to lessen the danger of infection in the performance of a hysterectomy; and to remove as much of the cancerous tissue as possible preliminary to cauterization in cases in which the disease is too extensive for a complete hysterectomy.

Fibromyoma of the Uterus.—Curetage may be performed in certain cases of fibromyoma of the uterus in which continued hemorrhage has produced marked anemia and prostration, in order that the patient may recuperate sufficiently to undergo a radical operation. The following case is a typical illustration: Miss E., aged forty-five, suffering from fibromyomata of the uterus, had bled so profusely for several months that when she came under my care examination of the blood showed but 10 per cent. of hemoglobin and but 2,325,000 erythrocytes. A thorough curetage checked the hemorrhage. At the end of three months there was 55 per cent. of hemoglobin and 3,770,000 erythrocytes. Supravaginal hysterectomy was performed, and the patient made an uneventful convalescence.



FIG. 200.—KELLY-SIMS' SHARP ANGULAR CURET WITH SERRATED EDGE.

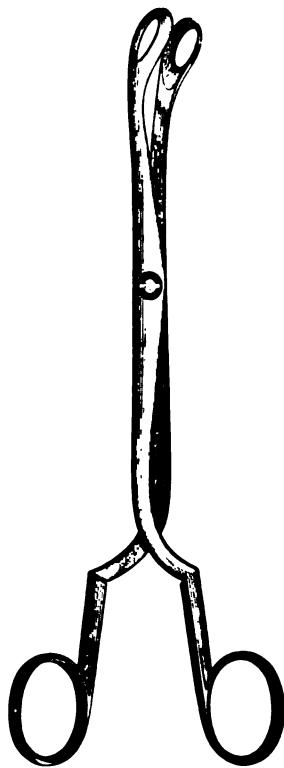


FIG. 201.—NOBLE'S CUTTING CURET FORCEPS.

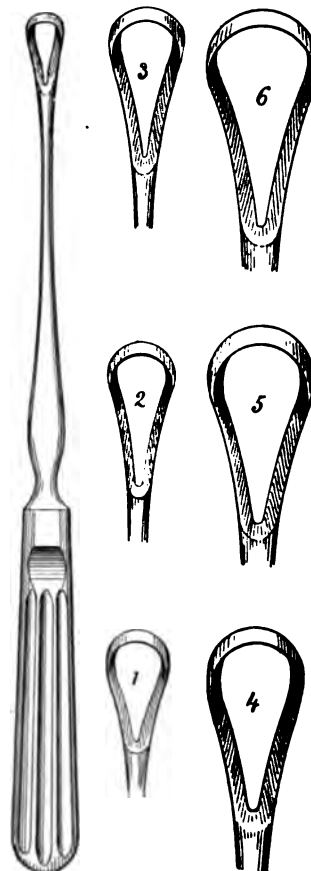


FIG. 202.—SIMS' SHARP CURETS. SIX SIZES.

In cases of submucous fibromyoma curetage should not be done, as all the mucous membrane cannot be removed, and therefore curetage will not control the hemorrhages from the uterus. A more serious objection to curetage is that the

capsule of the tumor may be wounded by the curet and the tumor may become infected and necrotic.

Contraindications.—The position of the uterus and the condition of the appendages should be determined before a curetment is performed. The uterus should not be cureted in cases in which there is a submucous fibroid, a pelvic peritonitis, an ectopic pregnancy, a pyosalpinx, or a pelvic abscess, unless the procedure is to be followed immediately by whatever operation may be necessary for the relief of the condition. A curetment should be done under strict aseptic

and antiseptic precautions and not looked upon as a trifling procedure which may be done without special care. The practice of performing curetage in the physician's office, and allowing the patient to go about subsequently, is especially reprehensible.

Operation.—The preparation of the patient is considered on page 347.

Curetage should always be preceded by dilatation of the cervix, for the technic of which see page 359. The uterine cavity should be cureted carefully and thoroughly. It is best to use curets of various sizes and shapes rather than a single curet. For the non-puerperal uterus the most efficient curet is the Sims angular sharp curet, with either a plain or a serrated edge (Figs. 199, 200). This form of curet will remove the superficial layers of the mucosa more thoroughly and rapidly than any other. It should be followed by a curet with a broader blade (Fig. 202) in order to remove the irregularities left by the narrower instrument. The mucous membrane of the fundus is best removed with a pair of curet forceps (Fig. 201). When the endometrium has been removed thoroughly, as indicated by the grating sensation conveyed

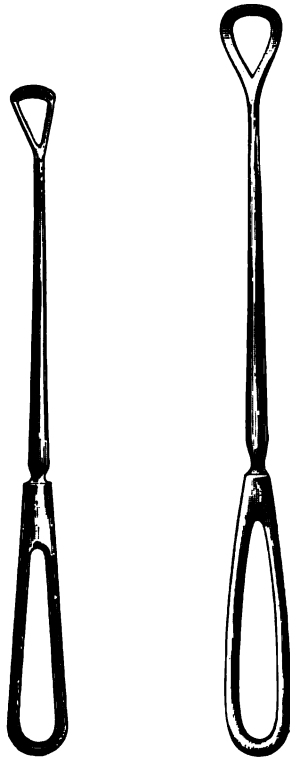


FIG. 203. — HIRST'S
CURET FOR THE
PUERPERAL UTER-
US.

FIG. 204. — NOBLE'S
DULL CURET FOR
THE PUERPERAL
UTERUS.

to the hand by the impact of the curet upon the muscularis, the uterine cavity is irrigated with sterile water through a Fritsch-Bozeman return-current uterine irrigator (Fig. 43). The vagina is then dried out and a sterile pad applied to the vulva.

In cureting the puerperal uterus special care must be taken not to perforate its walls, which are soft and frangible. As indicated elsewhere, in the presence of infection the employment of the curet is of doubtful value. When infection is not present and when the cavity of the uterus contains remnants of placenta or decidua,

these should be separated with the finger, and then the uterus should be cureted lightly with a dull curet (Fig. 203 or 204).

It is unnecessary to pack gauze into the uterine cavity after curetment, except in rare cases which bleed profusely after the operation, and in certain puerperal cases in which the presence of the gauze is desired to stimulate contraction of the uterus. When introduced, it should be removed after twenty-four hours.

After-treatment.—The patient remains in bed about one week; is given a daily vaginal douche of two quarts of formaldehyd solution (1 : 4000); and the external genitals are irrigated after each defecation or urination with formaldehyd solution (1 : 4000). The first two or three days following the operation the vulva is covered with a sterile pad. Liquid diet is given until the patient's appetite returns, when it can be rapidly increased to full diet.

Prognosis.—Under typical conditions the operation is a safe one, and should be followed by prompt recovery. It may have decided dangers and be followed by a fatal termination.

Should the uterus be perforated during the operation, two lines of treatment may be carried out—either to pack the cavity of the uterus with gauze and allow the opening to close spontaneously, or to open the abdomen and suture the rent. The latter procedure is rarely necessary, but should be done when there is evidence of free hemorrhage into the abdomen, when any of the abdominal viscera have been injured, and when the contents of the uterus are known to be septic. When the operator suspects perforation of the uterus, the point should be settled by careful exploration of the uterus with a sound. In cases of perforation, irrigation of the uterus must be strictly avoided.

The author was once obliged to open the abdomen because of evidences of internal hemorrhage from perforation of the uterus with the curet forceps in a uterus softened by recent pregnancy. Suture of the rent in the uterus and removal of blood in the pelvis were followed by a good recovery.

On another occasion the author was called to see a woman in whom a general practitioner, in cureting for an incomplete abortion, had perforated the uterus and had caught hold of and pulled down into the vagina a loop of the small intestine. On opening the abdomen the hole was found in the fundus of the uterus. Three feet of the small intestine was found torn from its mesentery and the abdomen contained considerable blood. The patient made a good recovery after closing the rent in the uterus, resecting the detached bowel, and making an end-to-end anastomosis with the Murphy button.

In a case seen by M. D. Mann, of Buffalo,¹ a young practitioner had dilated the cervix in order to remove the ovum in an early abortion. In using a sharp curet and his finger after cleaning out the ovum, he caught hold of and tore across a loop of the intestine. Mann opened the abdomen and found a rent in the center of the fundus large enough to admit the finger; the ileum was divided

¹ Mann, M. D.: "Perforation of the Uterus after Abortion, with Prolapse of Intestine," *Amer. Jour. Obstet.*, 1895, p. 603.

near the ileocecal valve, and was separated from its mesentery for six inches; the head of the colon was bruised and infiltrated, and the abdomen contained blood and feces. The patient recovered after the closure of the rent in the uterus, the inversion of the head of the colon, followed by the removal of the detached bowel, and the making of a new ileocecal anastomosis with the Murphy button.

The literature contains numerous accounts of perforation of the uterus by the curet, and doubtless the accident has occurred much oftener than it has been reported. The striking fact about the reports is that when the accident has occurred in the hands of trained surgeons, almost invariably the patients have recovered, usually after packing the uterus with gauze, occasionally after the performance of an abdominal section. On the other hand, death has followed very frequently when the accident has occurred in the hands of the occasional and inexpert surgeon, partly because of the lack of asepsis in the technic, and more frequently because the operator was not prepared, either by training or by having the necessary apparatus and assistants, to perform an abdominal section and correct the injuries inflicted by the curet.

TRACHELORRHAPHY.

By trachelorrhaphy is meant the repair of laceration of the cervix uteri by denudation of the surfaces of the original wound and its closure by sutures.

Laceration of the cervix uteri, as a fact, has been recognized since ancient times. Various text-books on obstetrics published during the eighteenth century referred to the "cleft condition of the cervix" as a product of difficult confinement, and some of them make reference to the cicatricial tissue in the cervix, the result of previous laceration, as a cause of tedious labor. J. H. Bennett¹ wrote extensively concerning the appearances and results of the lesion, but did so under the title of ulceration of the cervix. Under this title laceration of the cervix with ectropion was formerly treated by the use of caustics in order to heal the supposed ulcers. It remained for Thomas Addis Emmet to discover the nature of the lesion and to devise a suitable operation for its cure, which he did in 1862. Emmet published several papers upon the subject, and firmly established the nature of the lesion and the operation for its cure in modern literature and practice.²

Indications.—The existence of a laceration of the cervix, even though considerable in extent, is not necessarily an indication for its repair by operation. The typical case for operation is that in which laceration of the cervix is followed by subinvolution of the uterus, by hypertrophy and ectropion of the cervix, by infection and occlusion of the glands of the cervix, and development of the so-called Nabothian cysts, with such accompanying symptoms as menorrhagia,

¹ Bennett, J. H.: "A Practical Treatise on Inflammation of the Uterus, its Cervix and Appendages," Philadelphia, 1853.

² Emmet, Thomas Addis: "Surgery of the Cervix," Amer. Jour. Obstet., February, 1869; "Laceration of the Cervix Uteri as a Frequent and Unrecognized Cause of Disease," *ibid.*, November, 1874; "The Proper Treatment for Lacerations of the Cervix," Amer. Practitioner, January, 1877.

leukorrhea, backache, and reflex nervous disturbances. In such a case, when the position of the uterus is normal and there are no other complicating conditions present, the effect of the operation in the cure of the local lesions and the relief of the various symptoms is positive and most satisfactory.

Various factors must be considered in deciding whether or not a particular laceration of the cervix shall be operated upon. In women of child-bearing age an uncomplicated laceration of the cervix which is producing no symptoms need not be operated upon. A young woman free from symptoms from the lesion would necessarily derive no symptomatic benefit from the operation. The fact that a subsequent labor might reproduce the lesion is a valid reason for avoiding operation under such circumstances.

It is now generally believed that an etiologic relation exists between lacerations of the cervix and cancer of the cervix, therefore when a woman has reached the age of thirty-five, the possible risk of cancer, especially if the glands of the cervix are diseased, makes the indication for operation stronger than it would be in a younger woman. It is my own opinion that cancer of the cervix would be less frequent if all lacerations of the cervix were repaired. When the likelihood of child-bearing is past, this factor should be considered in all cases, and especially in lacerations accompanied by disease of the cervical endometrium or hypertrophy of the cervix itself.

The rule is becoming more general in maternity hospitals to repair lacerations of the cervix either at the time of their occurrence or about a week after labor than was formerly the practice.

In considering the indications for trachelorrhaphy it must be recognized that the cervix is normally intact and that any laceration is a departure from the normal; therefore, while trachelorrhaphy is not called for in young women with slight lacerations or with lacerations of greater degree which do not produce symptoms, at the same time these should be repaired if operation is demanded for the cure of other lesions, as, for example, the laceration of the perineum.

Contraindications.—Trachelorrhaphy is contraindicated in young women having slight lacerations of the cervix or having lacerations producing no symptoms and not associated with disease of the cervical endometrium or hypertrophy of the cervix. Because of the etiologic relation existing between lacerations of the cervix and cancer of the cervix uteri, these contraindications should not hold in women approaching the climacteric period.

Trachelorrhaphy is contraindicated when laceration of the cervix is complicated by salpingitis, and especially by pyosalpinx or abscess of the ovary, unless these inflammatory conditions are removed by operation prior to the operation upon the cervix or at the same time. A disregard of this contraindication is apt to cause pelvic peritonitis, either immediately after the operation from traction upon the uterus with leakage of pus from the appendages, or subsequently by interfering with free drainage from the uterine cavity. Disease of the uterine appendages should be excluded by careful bimanual palpation before trachelorrhaphy is advised.

Clinical History.—The clinical history of laceration of the cervix uteri depends upon numerous factors. If the labor or abortion at which the laceration occurs is not complicated by infection, frequently the laceration heals wholly or in large part. Should healing not take place and should the uterus maintain its normal position and the pelvic floor be intact, not infrequently no symptoms are produced by the laceration. When infection occurs, healing of the wound is interfered with, subinvolution and retroversion of the uterus frequently follow, and endometritis, more especially of the cervical endometrium and glands, is a common complication. Under these conditions leukorrhea, menorrhagia, metrorrhagia, pelvic tenesmus, backache, reflex nervous disturbances, and semi-invalidism are common results, and are caused by the complications present even more than by the laceration itself. Interference in the circulation of the cervix caused by the laceration and infection of the glands of the cervical endometrium commonly results in ectropium of the cervical mucous membrane and hypertrophy and distortion of the cervix uteri. Various reflex neuroses were formerly attributed to the pinching of the cervical nerves by the scar tissue which forms in the angle of the laceration. While this theory probably has some basis in fact, there is no doubt that its importance has been greatly exaggerated. Many neuropathic women with minor lacerations without real disease of the uterus have been subjected to trachelorrhaphy in the past without benefit through a mistaken belief in this teaching.

Etiology.—Imperfect development of the cervix predisposes to laceration of this organ in labor. Difficult labor caused by early rupture of the membranes, an unfavorable position of the head, precipitate labor, and large size of the fetal head, are the common causes of laceration of the cervix. The use of the obstetric forceps introduced through the partly dilated cervix is another common cause. Laceration of the cervix will be a less frequent accident when the first stage of labor is conducted in accordance with good obstetric principles.

Diagnosis.—The diagnosis of laceration of the cervix is made by palpation and inspection. Upon palpation the cervix is found fissured upon one or both sides in an irregular manner—the so-called stellate lacerations. The lacerations are usually more or less lateral. Sagittal lacerations are infrequent. Upon inspection of the lacerated cervix through a vaginal speculum, the lacerations are seen, as a rule, complicated by eversion of the cervical lips and more or less ectropium of the cervical mucous membrane. Frequently the cervix is much hypertrophied and studded with small cysts due to the occlusion of the Nabothian follicles. Laceration of the cervix must be differentiated from ectropium of the cervical mucous membrane by studying the contour of the external os uteri and searching for rents or scars in its outline. Separating the lips of the cervix with tenacula and rolling them together is of service in making the diagnosis.

Preparation of the Patient.—The preparation of the patient is the same as for all plastic operations (page 347).

Operation.—The preparation of the patient upon the operating table is the same as for curetage. The perineum and posterior vaginal wall are retracted with

an Edebohls self-retaining speculum, thus exposing the cervix, which is grasped at the anterior lip with a pair of double tenaculum forceps and pulled down gently toward the vulva. Trachelorrhaphy should be preceded by dilatation of the cervix and irrigation of the uterine cavity with sterile water; usually it is best also to curet the endometrium. If menstruation is normal and there is no complicating endometritis or glandular hypertrophy of the corporeal endometrium, curetage is superfluous. Exploration and irrigation of the endometrium eliminate possible complications from this source. The posterior lip of the cervix is now caught by a second double tenaculum forceps and the extent and direction of the laceration studied. If the laceration is lateral or bilateral, the operation is best begun by splitting the cervix upon one or both sides to the original extent of the laceration. The flaps are then outlined with a scalpel. Care must be taken to leave a sufficient amount of mucous membrane in the middle line upon the anterior and posterior lips to form the restored cervical canal. The flaps are then removed by means of the scalpel and dissecting forceps. The general character of a typical operation is well indicated by Figs. 205, 206. The outline of the flaps must naturally correspond with the laceration in the particular case.

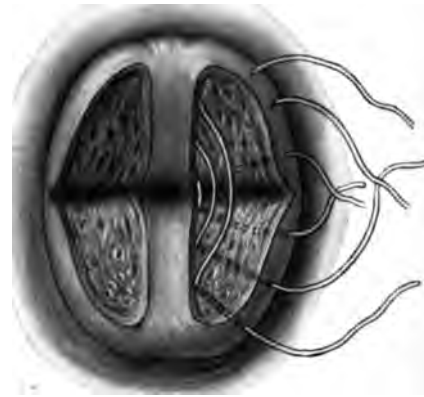


FIG. 205.—TRACHELORRHAPHY FOR LACERATION OF THE CERVIX.

The bilateral laceration is denuded. A strip of mucous membrane is left upon each lip for the new cervical canal. The sutures are in position.



FIG. 206.—TRACHELORRHAPHY FOR LACERATION OF THE CERVIX.

The sutures are tied.

When the lacerations are multiple, at times it is not feasible to reconstruct a cervix having enough tissue to perform the functions of the cervix in labor. In cases in which imperfect development of the cervix has been the predisposing cause of the laceration, a cervix of normal form cannot be constructed by trachelorrhaphy. In such cases it is best to substitute amputation for trachelorrhaphy, as a subsequent labor would almost surely reproduce the laceration. In other cases one lip (usually the anterior) is much hypertrophied and does not correspond with its fellow. In order to make a cervix of normal contour, it is necessary to combine a partial amputation of one lip with the typical trachelorrhaphy.

If the hypertrophy involves more especially the endometrium, the situation may be dealt with by excising a wedge-shaped piece (by transverse incisions) from the mucous membrane and submucous tissues of the anterior lip. In other cases the extremity of the anterior lip may be amputated. Formerly it was the practice in cases of laceration

of the cervix complicated by marked hypertrophy and cystic degeneration to carry out a prolonged preparatory treatment by puncturing the cysts, scarification of the cervix to withdraw blood, and the use of glycerin tampons and hot douches for six or more weeks. In these cases it is better to amputate the diseased cervix rather than to attempt trachelorrhaphy. In younger women, when the above conditions are but moderately developed, the older practice may be carried out with advantage, but certainly in women who are thirty-five years of age or more it is better to resort to amputation.

The wounds are now closed by sutures. Chromicized catgut is to be preferred, as suture material, as it does not require removal, and at the same time resists absorption until healing is perfect. Ordinary catgut answers as well for cases in which the denuded surfaces fall naturally together without tension. In most cases, however, owing to hyperplastic changes in the cervix, the wounds are brought together under more or less tension and a more lasting suture is preferable. Formerly silkworm-gut and silver wire were used as suture material. These materials give excellent results, but require subsequent removal, which is an annoyance in all cases and quite a troublesome procedure when perineorrhaphy is performed at the same time as trachelorrhaphy. The sutures are best introduced by means of a full-curved needle and carrier, the needles being passed by means of a needle-holder (Fig. 187). The first suture should be passed at or above the upper extremity of the laceration. The needle is introduced through the mucous membrane of the outer surface of one lip of the cervix, is made to describe the arc of a circle through the cervical tissue, and to emerge through the denuded surface at the border of the cervical mucous membrane. The reverse of the process is carried out through the other lip. It is well to draw the suture through one lip before passing the needle through the other. The sutures are introduced at intervals of a quarter of an inch, and when all are passed the surface of the wound is irrigated and the sutures are tied. The typical procedure is to tie the upper sutures first. There are some advantages in reversing this order, as the contour of the external os is more apt to be normal. In passing the sutures the usual instruction is to have the needle emerge through the cervical mucous membrane. As indicated above, I believe it is better to pass the suture just external to the border of the mucous membrane, as this leaves the cervical canal more patulous and thus facilitates drainage from the uterine cavity.

Operations upon the cervix, and also the various other plastic operations upon the birth canal, are facilitated by the use of continuous irrigation to wash away the blood from the field of operation. A hard-rubber irrigator nozzle (Fig. 183), having a ball-and-socket joint, introduced in America from Sweden by Edebohls, is a convenient apparatus for this purpose. The irrigator is attached to a hose from a douche bag or other convenient container to hold sterile water or salt solution. The screw shut-off of Ill is also an excellent device (Fig. 184). Some surgeons prefer to attach the hose to a specially prepared retractor for the anterior vaginal wall, which acts both as a douche nozzle and as a retractor. When trachelorrhaphy is

performed with the patient in the Sims position, it is necessary to use either marine or gauze sponges to keep the field of operation dry. This method has its advocates, but in my judgment is much inferior to the use of continuous irrigation, as much of the operator's time is wasted while waiting for an assistant to sponge the wounds.

AMPUTATION OF THE CERVIX.

By amputation of the cervix uteri is meant the removal by operation of more or less of the cervix uteri. The operation may be confined to the vaginal portion or may extend above the vagina and involve the removal of the entire cervix. The lesser operation is done for laceration of the cervix, for ectropium of the cervical mucous membrane, for chronic inflammation of the mucous membrane of the cervix, for hypertrophy of the cervix, and as one step in the series of operations for procidentia uteri. The larger operation is done for cancer.

Ambroise Paré¹ appears to have been the first surgeon who advised amputation of the cervix. In 1802 the operation was systematized by Osiander, who performed it 23 times. After this it was resorted to by Dupuytren, Récamier, Lisfranc, and others. The operation was done by means of the bistoury, scissors, the *écraseur*, and the galvanocautery. The method of amputating the cervix by means of the galvanocautery was perfected by the late John Byrne, of Brooklyn.² The operation as done by each of these methods left the cervix as an uncovered stump to heal by granulation. In 1859 J. Marion Sims introduced the method of covering the amputated cervix with flaps of vaginal mucous membrane, so as to obtain union by first intention.³ The name of Karl Schroeder should also be associated with the operation of amputation of the cervix, as he devised special methods of operation for both inflammatory and cancerous disease of the cervix.

Conditions for which the Operation May be Done.—Amputation of the cervix is indicated in certain cases of cancer of the cervix; in certain cases of ectropium of the cervix accompanied by profuse leukorrhea and by reflex nervous disturbances; in certain cases of cervical endometritis with cystic degeneration from occlusion of the ducts of the Nabothian glands; in certain cases of laceration of the cervix uteri in which owing either to lack of development of the cervix or to the irregular nature of the lacerations, or to sloughing of the cervix following the injuries, there is not enough sound cervical tissue out of which to construct a normal cervix by trachelorrhaphy; in cases of hypertrophy of the infravaginal cervix; and in cases of procidentia.

The reader is referred to the various chapters on operations for cancer of the uterus for a full discussion of the relative merits of hysterectomy *versus* amputation of the cervix for carcinoma of the cervix uteri. It is my own conviction that amputation of the cervix should be done for cancer only in those cases in which hysterec-

¹ Paré, Ambroise: *Oeuvres d'Ambroise Paré*, lib. xxiv, 1012.

² Byrne, John: "Electrocautery in Uterine Surgery," New York.

³ Sims, J. Marion: "Amputation of the Cervix Uteri," *Trans. Med. Soc. State of New York*, 1861.

tomy is not feasible, either because the disease has so invaded the periuterine tissue as to contraindicate the operation, or the consent of the patient cannot be obtained for the performance of hysterectomy, or the physical condition of the patient forbids a major operation. When amputation of the cervix for cancer is restricted to advanced cases, it necessarily becomes an atypical operation and is done as a part of the curetage of the broken-down cancerous tissue. Under these conditions the operation should be done in accordance with the principles laid down by Byrne. In the rare instances in which amputation is done for cancer of the cervix in its early stages, the technic of Byrne should be used; but if the method of amputation by the knife and scissors is employed, the technic of operation will vary but little from that presently to be described for non-malignant cases. The variation will consist in the wider removal of the vaginal mucous membrane around the cervix, in the stripping off of the bladder from the anterior wall of the cervix as in vaginal hysterectomy, in the ligation of the uterine arteries, and in amputating the cervix at a higher level before covering the cervical stump with flaps from the vaginal mucous membrane. In such cases Douglas' pouch should be opened in order to insure the complete removal of the cervix. The opening into the peritoneum should be closed with sutures before covering the stump of the cervix with the vaginal flaps.

Certain cases of ectropium of the cervical mucous membrane call for amputation. Laceration of the cervix is the most common cause of ectropium of the mucous membrane of the cervical canal. Such cases are to be dealt with as a part of the laceration. Ectropium of the cervix may occur in nulliparæ and also in virgins. Fischel¹ calls attention to the fact that a congenital malformation of the cervix may resemble a laceration. He reports a case in which the cervix of a newborn infant presented an inferior degree of this condition. The separation of the lips extended two-fifths of the distance to the vaginal junction. The case shows that a peripheral notching of the cervix is not always the sign of a previous labor. Penrose² reports the case of a virgin in which the cervix was mushroom-shaped, the face of it being round and about half an inch in diameter. The external os was transverse and one-third of an inch broad. Upon the face of the cervix were several scattered patches of erosion. The cervix was amputated and examined microscopically, with this result: "The cervix was covered with squamous epithelium, except on the small patches of erosion, where cylindric epithelium was present. Racemose glands (like the normal glands of the cervical canal) opened all over the face of the vaginal cervix, in front, behind, and to the sides of the external os. They were found as far as one-half to three-quarters of an inch from the external os. These glands opened on the vaginal aspect of the cervix, where it was covered with squamous epithelium, and this epithelium extended to the ducts of the glands, which were lined with cylindric epithelium. The vaginal cervix was, in fact, a glandular structure." Penrose considers that this condition was congenital in

¹ Fischel, Wilhelm: "Beiträge zur Morphologie der Portio vaginalis uteri," *Archiv f. Gynäk.*, 1880, Bd. xvi, S. 192.

² Penrose, Charles B.: "Congenital Erosion and Split of the Cervix Uteri," *Amer. Jour. Med. Sciences*, May, 1896.

origin and due to the development upon the vaginal aspect of the cervix of those structures which are normally confined to the cervical canal. Cervices having the contour of a mushroom or of a pig's snout very commonly present erosions, but, as a rule, instead of having a "split" of the cervix suggestive of a laceration they have a narrow os uteri—so-called "pinhole" os. In other cases ectropium in nulliparæ or virgins is apparently due to long-continued pelvic congestion, and in some cases the conditions present closely resemble a laceration of the cervix.¹ In one such case in which amputation of the cervix relieved the local and general symptoms the tissues removed were examined by Thomas S. Cullen, whose report was an "eversion of the normal cervical mucosa." Any cases of ectropium producing symptoms, whether reflex nervous disturbances or leukorrheal discharges, which cannot be relieved by local treatment call for amputation.

Certain cases of chronic inflammation of the mucous membrane of the cervix call for amputation. A striking difference between cervical endometritis and corporeal endometritis is that when the mucosa and glands of the cervix become infected there is not only but little tendency toward spontaneous recovery, but also and most unfortunately local applications seldom prove of lasting benefit; whereas inflammation of the corporeal endometrium tends toward spontaneous recovery. The puncture of cysts, together with scarification of the cervix, thereby extracting blood, and the use of glycerin tampons at regular intervals, with applications of Churchill's tincture of iodine or carbolic acid to the cervical endometrium, will frequently result in temporary improvement in case of cervical endometritis; but, as a rule, the condition recurs.

Gonorrhea is probably the most frequent cause of cervical endometritis, and this type of the affection is most rebellious to treatment. Other cases are caused by laceration of the cervix and by puerperal infection. In still others, in nulliparæ, the nature of the infection is not clear. Tuberculosis is the rarest cause.

The principal symptoms of cervical endometritis are leukorrhea, pelvic discomfort, and reflex nervous disturbances. The chief symptom is an annoying leukorrhea, in many cases puriform in character, in others being thick, gelatinous, andropy. The lesser grades of cervical endometritis, especially those not due to gonorrhea, may yield to systematic local treatment; but when the infection is marked with numerous occluded gland ducts, causing the so-called cystic degeneration of the cervix and marked hypertrophy, amputation will usually be necessary. Curetage of the cervical canal will effect a cure in cases of mild type.

Certain cases of laceration of the cervix are best treated by amputation. When the conditions present are such that by trachelorrhaphy a normal or fairly normal cervix may be secured, this operation is to be preferred. In other cases amputation should be done. When the predisposing cause of the laceration has been imperfect development of the cervix, if trachelorrhaphy is attempted a very imperfect cervix is secured. Subsequent pregnancy and labor will almost inevitably result in a

¹ Noble, Charles P.: "Ectropion of the Cervix in Nulliparæ Resembling Laceration of the Cervix," *Amer. Gynec. and Obst. Jour.*, February, 1897.

new laceration. For this reason it is best to amputate such cervixes. Also, when the lacerations have been associated with sloughing, so that normal cervixes cannot be secured by trachelorrhaphy, amputation is to be preferred. In cases of laceration of long standing, with marked hypertrophy of the cervix together with cystic degeneration, amputation is to be preferred, as the conditions left by trachelorrhaphy are far from normal. In cases where the lacerations are multiple and so numerous as to make it impossible to secure a normal cervix by denuding and repairing the lacerations, amputation is to be preferred. In women past thirty-five, especially when the cervix is either hypertrophied or the seat of cystic degeneration, amputation has the advantage over trachelorrhaphy that by means of it the tissues most prone to develop epithelioma of the cervix are removed. In younger women amputation has one disadvantage in comparison with trachelorrhaphy, as it is probably true that there is a greater tendency for the uterus to become retroverted after amputation than after trachelorrhaphy.

Hypertrophy of the infravaginal cervix is treated by amputation. The nature and causation of this condition are obscure. It occurs in virgins as well as in married women. It is probable that it is congenital in origin. The symptoms are largely mechanical. The condition may exist without symptoms until the cervix presents at the vulva, the fundus occupying its normal position. Aside from the mechanical symptoms due to the enlargement of the cervix, the symptoms are largely due to accidental complications. The diagnosis is easily made by recognizing the enlargement and elongation of the cervix and determining that the vaginal fornices retain their normal relations; or if the hypertrophy involves the cervix immediately above the anterior vaginal wall, the anterior fornix may be pushed down by the growing cervix, while the posterior fornix occupies its normal relations. The hypertrophy of this portion of the cervix is differentiated from elongation of the supravaginal portion by this relation of the anterior to the posterior fornix. In elongation of the supravaginal cervix both fornices are dragged down and the vaginal portion of the cervix is but little, if at all, hypertrophied.

Prolapse of the uterus calls for amputation of the cervix as one step in the series of operations necessary for the cure of this complicated condition. In prolapse of the uterus almost invariably there is elongation of the supravaginal portion of the cervix, and, as a rule, but little hypertrophy of the vaginal portion unless the cervix be lacerated and hypertrophied as a result of the laceration. Amputation of the cervix properly performed accomplishes several objects in the treatment of prolapse of the uterus. The uterus itself is made smaller and its cavity is directly lessened in depth by the amount amputated. The hypertrophy of the uterus usually present, as a rule, undergoes involution secondary to the operation, that is, the amputation promotes involution of the uterus. When in addition to the amputation itself the bladder is stripped off the anterior surface of the cervix as far as the internal os, or even in extreme cases as far as the peritoneal reflection, and when the anterior vaginal wall is sutured to the anterior surface of the cervix as high as the internal os or higher, it has the effect of elevating the position of the

bladder—a useful step in the cure of cystocele or prolapse of the bladder, which so commonly accompanies prolapse of the uterus, more especially in elderly women.

Contraindications.—The position and the condition of the uterus, and more especially the condition of the uterine appendages, must be determined before the operation of amputation of the cervix is undertaken. Inflammatory disease of the uterine appendages positively forbids the performance of amputation of the cervix, unless an abdominal section to deal properly with the condition of the tubes and ovaries is to follow the plastic operation; otherwise the traction upon the uterus and the various manipulations of the cervix may easily set up an attack of pelvic peritonitis. Gross disease of the body of the uterus, such as a fibroid tumor, contraindicates amputation of the cervix unless an operation to remove the tumor is to follow the plastic operation. Many surgeons prefer pan-hysterectomy under these conditions rather than amputation of the cervix followed by supravaginal hysterectomy for the removal of the tumor. In a considerable number of cases, however, I have combined amputation of the cervix with supravaginal hysterectomy with entirely satisfactory results.

The preparation of the patient for operation is the same as for all plastic operations.

Operation.—The operation is most conveniently performed with the patient in the lithotomy position. It should be preceded by dilatation of the cervix and curetage of the uterus to remove the endometrium, if diseased, and to permit the irrigation of the uterine cavity to remove any septic material which it may contain. The perineum and posterior vaginal wall are retracted with the Edebohls self-retaining speculum, thus exposing the cervix, which is grasped by means of two double tenacula, one in each lip, and pulled down gently toward the vulva. After the curetage and irrigation of the uterus the lips of the cervix are separated by traction upon the tenacula, and the cervix is split transversely as deeply as called for in the particular case. In the typical case the split does not extend as deeply as the vault of the vagina, so that when the operation is completed there will still be a portion projecting into the vagina instead of leaving the cervix flush with the vaginal vault. The entire cervix being then drawn forward toward the pubes, a curved incision is made beginning at the left side of the incision through the cervix near the vaginal vault and extending downward and inward to or below the line of the vaginal reflection upon the cervix, then crossing the middle line of the cervix and extending upward in the same way to a corresponding point upon the right side of the cervix. With a sharp knife a flap is easily turned back consisting of vaginal tissue and the superficial layers of the posterior wall of the cervix. When the flap has been made or turned back to a point corresponding with the original split in the cervix, the remaining portion of the posterior lip of the cervix is amputated by a transverse incision made either with the knife or scissors. As a rule, there is but little bleeding, and traction with a double tenaculum forceps is usually sufficient to control it. If bleeding vessels are present, they may be caught with artery forceps. The anterior lip is now incised in a similar way. If the flap of

vaginal tissue is elevated with a dissecting forceps and care is taken to keep the knife within the cervical tissue, this flap may be turned back without risk of wounding the bladder. When the anterior flap is made to correspond with the posterior, the remaining portion of the cervix is amputated by a transverse incision made with the knife or scissors. If the amount of bleeding at this stage of the operation is trifling, the suturing of the cervix may now be done. If, however, the bleeding vessels are of considerable size, they should be secured. If the vessels are in the vaginal wall, they are best secured by means of free ligatures; if in the cervix, it is best to pass a suture by means of a curved needle through the outer border of the cervix upon each side, which when tied will control the branches of the cervical artery. Cumol catgut is the best suture material for this purpose. Chromicized catgut sterilized by the cumol method, or other approved procedure, is the best material for the operation itself. It is not absorbed until sound healing has taken place, and, on the other hand, does not require removal, which is a great advantage when operations upon the vaginal walls and perineum are done in connection with amputation of the cervix. The sutures are passed by means of a full curved fistula needle and carrier. The needles are most conveniently introduced by means of a needle-holder, such as the Noble modification of the Reiner needle-holder (Fig. 187). The cervix is held by means of a double tenaculum forceps introduced at one side of the cervical canal. The anterior flap is picked up with dissecting forceps and the needle passed through it about half an inch from its lower border. The needle is then introduced through the anterior lip of the cervix in the median line, emerging from the cervical canal. The anterior flap of vaginal tissue is again picked up with a dissecting forceps and the needle passed in and out through the vaginal mucous membrane, emerging near the point of entrance of the suture. By this means the knot is tied some distance from the new os. In practice it is best to pull the suture through the cervix before making the secondary suture of the vaginal mucous membrane, as in this way the suture is drawn through the tough cervical tissues with greater facility. This suture, which may be called No. 1, should be of medium weight catgut (No. 3 of the Kny-Scheerer scale). The purpose of this suture is to fasten the vaginal flap to the cervical stump. Two fine sutures are passed upon each side of No. 1 through the flap of vaginal tissue and through the cervical mucous membrane only. The purpose of sutures Nos. 2 and 2' is to make a neat approximation of the vaginal mucous membrane and that of the cervical canal. Similar sutures are passed through the posterior lip and posterior vaginal flap, Nos. 1, 2, and 2'. Suture No. 3 is passed through the anterior vaginal flap, through the face of the cervix to the left of the cervical canal, and emerges through the posterior vaginal flap. The purpose of this suture is to cover the face of the stump with vaginal mucous membrane. Suture No. 4 may be called the ligature suture, as it is passed from the outer border of the cervix through the vaginal mucous membrane, through the wall of the cervix to the cervical canal, again through the wall of the cervix to its outer border, and through the vaginal mucous membrane. When tied the suture grasps and controls the branches of the cervical artery.

Similar sutures, Nos. 3' and 4', are placed to the right of the cervical canal. (Fig. 207 shows the appearance of the stump and the relation of the various sutures.) In a typical case ten sutures well placed are sufficient to complete the operation. When the cervix is much hypertrophied and the amputation extends to or above the vaginal vault, additional sutures will be needed at the sides of the cervix. These are passed before any are tied, in order to avoid the risk of wounding the uterine vessels or their cervical branches, and in order to avoid the possibility of wounding the ureters. Such sutures are passed through the edge of the vaginal flap, through the outer border of the cervix, and through the corresponding vaginal flap in order to control the vessels which run at the side of the cervix. When the approximation of the vaginal flaps is not perfect, this may be secured by passing additional superficial sutures. A strip of gauze is passed into the uterus and removed two days after the operation as an additional safeguard against the closure of the cervical canal. With this technic this accident has never happened in my hands, but before the careful suturing to make the new os was practised one case of occlusion of the cervix was encountered. In order to prevent the occlusion of the cervix many surgeons make two flaps of the cervical mucous membrane, allowing these to project beyond the level of the amputated cervix, with the object of suturing the cervical mucous membrane to that of the vagina. This method undoubtedly secures that object, but it leaves the cervical mucous membrane exposed in the vagina, which subsequently gives the appearance of a cervical erosion. The technic here described is free from this objection.

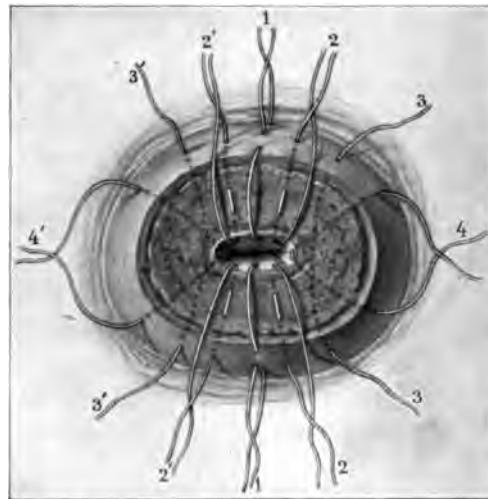


FIG. 207.—AMPUTATION OF THE CERVIX.
The cervix is amputated and the sutures are in position.

This typical amputation of the cervix must be modified to meet the necessities of the individual case. When amputation is done for ectropium, or for moderate lacerations of the cervix in poorly developed uteri, no more tissue is removed than can be avoided, in order to leave as nearly normal a cervix as possible. On the other hand, in cases of marked hypertrophy of the cervix with hypertrophy of the corpus, it is well to split the cervix well up to the vaginal vault. This is also true in most cases of prolapse of the uterus, in many of which it is advisable to continue the split of the cervix until the bases of the broad ligaments are exposed. Schroeder devised an operation for ectropium, erosion, and laceration of the cervix with infection of the utricular glands, in which the glandular portion of each lip was excised and the remaining portion of the lip folded upon itself, the lower edge

of the vaginal portion of each lip being sutured at or near the internal os. The lateral portions of the flaps were then trimmed and sutured together. This operation accomplished the purpose of removing the glandular portion of the cervix, but is more difficult of performance and probably gives inferior results to the technic described. In the rare instances in which amputation of the cervix is performed for cancer, the vagina is incised about half an inch from the cervix, the incision passing around the cervix about that distance from the vaginal reflection. This incision preferably is made with the electric or thermocautery knife. The bladder is then pushed off the anterior surface of the cervix and uterus as in vaginal hysterectomy. The Douglas pouch is then opened. The uterine arteries and their cervical branches are secured by ligatures, and then the cervix is amputated at the level of the internal os. Preferably the lateral attachments of the cervix are severed and the cervix is amputated with the cautery knife. The incision of the peritoneum into Douglas' pouch is now closed by suture. The final step in the operation is the attachment of the vaginal flaps to the stump of the cervix. When the cautery is used, accurate approximation of the flaps should not be attempted. The operator should be satisfied with suturing the anterior and posterior vaginal flaps to the face of the cervix, leaving openings for drainage at each side. The general principles followed in vaginal hysterectomy are followed in amputation; that is, the septic portion of the cervix is scraped away and the vagina and cervix are disinfected before the amputation is attempted. The peritoneal cavity also is protected by means of gauze pads introduced so soon as Douglas' pouch is opened. These are removed immediately before the peritoneum is sutured.

Continuous irrigation is the most convenient means of keeping the wound free from blood during the operation, but gauze sponges may be used by those who prefer the dry method. If during an amputation of the cervix the peritoneal cavity is opened, the irrigation must be stopped and the use of the gauze for sponges resorted to until the peritoneum is closed.

ANTERIOR COLPORRHAPHY.

By anterior colporrhaphy or elytrorrhaphy is meant an operation to lessen the caliber of the vagina by denudation of a portion of the anterior vaginal wall and the closure of the wound by sutures. As the operation is performed today, much more definite results than mere narrowing of the caliber of the vagina are usually secured, and the operation is more strictly a resection of the anterior vaginal wall, its object being the restoration of the anterior vaginal wall to the normal.

Anterior colporrhaphy was probably first suggested by Romain Gérardin in 1823.¹ The operation was independently conceived by Marshall Hall, and upon his suggestion was performed by Heming in 1831.² Dieffenbach first operated

¹ Gérardin, Romain: "Neue Radicalbehandlung des Prolapsus Uteri et Vaginæ bei Frauen in der Periode der Decrepitität," *Harless Neue Jahrbücher*, etc., 1825, Bd. x, Stück 1, p. 151; *Gazette Médicale de Paris*, Tome iii, 1835, p. 558.

² Hall, Marshall: "Case of Prolapsus Uteri Cured by a New Operation," *London Med. Gaz.*, vol. ix, 1831, p. 269; Heming, G. O.: "On the Cure of Prolapsus Uteri," *London Med. Gaz.*, vol. xvii, 1835, p. 266.

for prolapse of the uterus in 1828, but did a bilateral elytrorrhaphy. In 1836 he had performed the operation repeatedly and claimed excellent results.¹ Velpeau and other French surgeons were among the pioneers. In 1834 Ireland² operated for procidentia uteri by performing bilateral elytrorrhaphy. He varied the technic of Marshall Hall, but operated under the influence of his proposal. In 1835 Bérard reported a cure of prolapse of the uterus by means of the operation, and proposed to give it the name "elytrorrhaphy."³ The operation fell into disuse and was rediscovered and popularized by J. Marion Sims, who first performed it in 1856.⁴ Sims discovered the operation by a happy accident. It was his intention to make a large vesicovaginal fistula to cure a cystocele due to prolapse, but in attempting to remove the vesicovaginal septum with scissors fortunately the vaginal wall only was removed without opening the bladder. At this stage he abandoned his purpose of making a fistula and sutured the vaginal wound, thus performing excision of the anterior vaginal wall as is done at the present day. Subsequently he abandoned the excision of the vaginal wall and substituted a V-shaped denudation of the mucous membrane. The two sides of the V were united by sutures, turning in a pocket of vaginal mucous membrane. This operation was further modified by Emmet. These methods of Sims and Emmet are of interest historically, but have been abandoned for the original operation of Sims—namely, the resection of the anterior vaginal wall.

The technic of the resection of the anterior vaginal wall has been perfected by Hadra⁵ and Säger.⁶ The idea of resecting the anterior vaginal wall, at the same time making use of the anatomic relations between the vagina, the bladder, and the uterus, as a means of restoring the relation of these parts to the normal in cases of cystocele and prolapse, is original with Hadra. The operation which he devised was not so good as that of Säger. Säger gives full credit to Hadra for his original work, and to these two men must be given the credit for the development of the modern operation upon the anterior vaginal wall for the cure of cystocele and prolapse of the uterus. By this operation not only is the stretched out vaginal wall resected and restored to its normal dimensions, but the bladder is elevated by detaching it from the cervix, and then, by suturing the vaginal wall to the anterior face of the cervix as high as the internal os, the bladder is permanently elevated and the tendency to recurrence of the cystocele is thereby prevented.

Indications.—Anterior colporrhaphy or resection of the anterior vaginal wall is indicated for the cure of cystocele, or of cystocele complicated by prolapse of

¹ Dieffenbach, J. F.: "Ueber Mutterkränze und Radikalkur des Scheiden- und Gebärmutter-Vorfalles," *Medizinische Zeitung*, vol. v, 1836, No. 31, p. 151.

² Ireland: "Case of Procidentia Uteri Successfully Treated by Operation," *Dublin Jour. Med. and Chem. Science*, 1835, vol. vi, p. 484.

³ Bérard: "Chute de Matrice; élytrorrhaphie," *Gaz. Médicale de Paris*, T. iii, 1835, p. 541.

⁴ Sims, J. Marion: "Uterine Surgery," 1886, p. 205.

⁵ Hadra, B. E.: "Remarks on Vaginal Prolapse, Rectocele and Cystocele," *Amer. Jour. Obstet.*, May, 1889, vol. xxii, No. 5, p. 457.

⁶ Säger, Max: "Zur Technik der Prolapsoperation," *Centr. f. Gynäk.*, 1898, Nr. 2; *Ibid.*, 1892, Nr. 42.

the uterus. Cystocele is usually but not always associated with prolapse of the uterus, and both conditions usually constitute a part of hernia of the pelvic viscera. In young women cystocele almost never occurs without prolapse of the uterus. In elderly women who have passed the menopause not infrequently a cystocele may form without uterine prolapse. This is favored at this period of life by the absorption of fat in the vaginal connections which occurs after the climacteric. The usual cause of both prolapse of the uterus and cystocele is a laceration of the perineum. The three factors concerned are the sacral or supporting segment of the pelvic floor, the weight of the uterus, and intra-abdominal pressure. When the perineum is intact, prolapse seldom occurs even if the other two factors are disturbed. Rarely, as a result of increased abdominal pressure brought about by lifting or straining efforts, long continued, the uterus and bladder may be forced down. This has been known to occur in young girls, and also in women following a laborious occupation. Occasionally the uterus is forced down by the presence of a tumor increasing the weight of the pelvic contents. (For a further consideration of prolapse of the uterus see chapter on Prolapse of the Uterus.) As the primary cause of cystocele and prolapse of the uterus is almost invariably laceration of the pelvic floor, it follows that the restoration of the perineum must follow the operation upon the anterior vaginal wall in order to obtain a permanent cure. Without the support of an intact perineum, intra-abdominal pressure would soon reproduce the prolapse of the uterus and the vagina.

The diagnosis of cystocele is simple. In well-marked cases, upon examination, the prolapsed anterior vaginal wall will be seen projecting through the vaginal orifice. The prolapse is made more prominent by straining efforts on the part of the patient. The catheter passed into the bladder can be directed so that the vesical end of the catheter may be felt in the prolapsed bladder where it emerges through the vaginal orifice. At times the anterior vaginal wall, which has been pushed down in advance of the head of the fetus in labor, may become hypertrophied and present the appearance of a moderate cystocele. The differential diagnosis can be made by inserting the catheter into the bladder and determining whether or not the bladder wall constitutes a portion of the projecting mass.

The diagnosis of cystocele may be suggested by the symptoms in many cases. The most prominent symptom is that of pelvic tenesmus, with the escape of a soft tumor through the vulvar orifice. In other patients the bladder is irritable and there is a frequent desire to urinate. In some of the more marked cases the patient is unable to empty the bladder without first reducing the cystocele. Owing to this mechanical disadvantage, the bladder is not well emptied, and in certain cases the residual urine undergoes decomposition and causes cystitis. This is more apt to be true when the cystocele is marked and in elderly women in whom the resistance of the vesical mucous membrane to infection is not so good as in younger women.

Anterior colporrhaphy is the only satisfactory treatment for cystocele. Various pessaries have been invented, but all of them are unsatisfactory. The operation is always indicated unless the age or feebleness of the patient renders any operation

unwise. In my experience a thick soft-rubber ring pessary is more apt to retain the prolapsed bladder and uterus within the pelvis than any other variety of pessary. The reason that pessaries are unsatisfactory is that almost invariably the perineum is torn, so that there is no adequate support for the instrument. Another alternative to operation is the systematic daily tamponade of the vagina, a tiresome and unsatisfactory expedient.

Operation.—The preparation of the patient for operation is the same as for all plastic operations. The operation may be performed in the lithotomy position or in the Sims position. The Sims position undoubtedly has some advantages for this particular operation, but it has practically fallen into disuse and the lithotomy position is that which is now employed. The parts are exposed by retracting the perineum with an Edebohls self-retaining speculum. After the uterus and cervix have received such treatment as is indicated, the operation is proceeded with as follows: The anterior lip of the cervix is caught with a double tenaculum and drawn downward toward the vulva. The vaginal mucous membrane is caught about half an inch behind the external orifice of the urethra and drawn upward and forward. The anterior vaginal wall is then picked up with dissecting forceps in front of the cervical tenaculum and a fold or strip of vaginal wall is cut through with scissors, exposing the vesical wall. The strip may be removed from behind forward, under the guidance of the eye, as far as the second tenaculum (about half-way between the vesical and external orifices of the urethra), or, after the vesical wall is exposed, the bladder may be separated from the vaginal wall with the finger before the strip is removed. After the removal of the strip of vaginal wall, the vaginal walls upon each side are seized with artery forceps and the bladder is detached from the vagina laterally, by pressure with the finger or with gauze, as far as indicated in the particular case. In cases of prolapse of the uterus with cystocele it is always desirable to detach the bladder from the anterior surface of the cervix up to or above the level of the internal os. A strip of vaginal wall is then excised from each lateral portion. When the excision is completed, the defect in the anterior vaginal wall is ovoid in shape, the broader portion of the ovoid being toward the cervix. The amount of vaginal tissue to be removed in each case must depend upon the size of the cystocele. This is best determined by repositing the uterus within the pelvic cavity so as to estimate the breadth of the strip to be removed. In operations for prolapse of the uterus the tendency is to remove too much rather than too little vaginal tissue. This is especially true of the anterior end of the wound. If too much tissue is removed from the anterior vaginal wall, when the operation is completed, it must necessarily drag forward the lateral walls of the vagina, which in turn interferes with securing the best results from a perineorrhaphy. It would appear that this technic would subject the bladder to considerable risk. Practically, however, the risk of wounding the bladder is slight, as the areolar tissue connections between the bladder and vagina are quite loose. In a large series of operations the bladder has been wounded but once in my hands. It was immediately sutured with catgut and gave no subsequent trouble.

The vaginal wound may be sutured with either interrupted or continuous sutures. The interrupted suture gives a neater result at the completion of the operation, but the ultimate result is no better than that secured with a continuous suture. As the continuous suture can be introduced more rapidly, it is usually employed. The suture should be introduced as follows: A medium weight cumol catgut suture threaded on a full-curved fistula needle is introduced through the vaginal wall near the anterior or lower end of the incision. The under edges of the cut vagina are caught with the needle so as to approximate the deeper layers of the vagina. After the

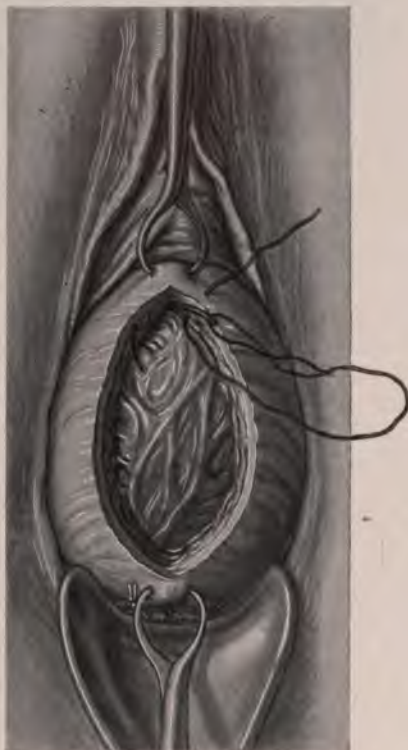


FIG. 208.—ANTERIOR COLPORRHAPHY I
The anterior vaginal wall is resected. The suturing is begun.

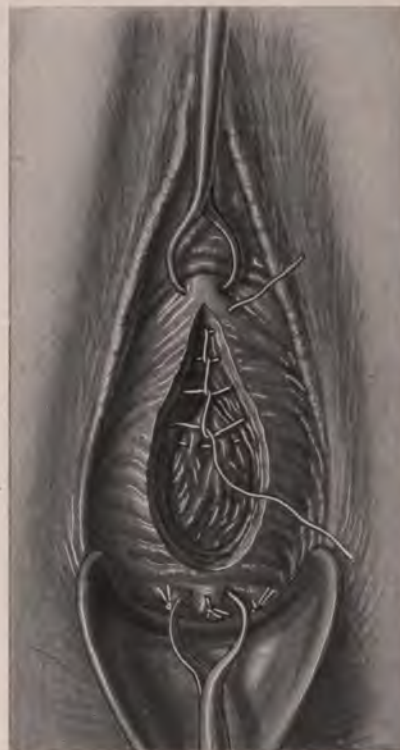


FIG. 209.—ANTERIOR COLPORRHAPHY II.
Placing the half-hitch sutures to unite the deeper layer of the vagina and to attach the bladder to the vagina.

first turn of the suture is tightened, it is desirable to introduce the suture in the form of a half-hitch (Fig. 209), as this device lessens the tendency of the continuous suture to draw the cervix forward in the pelvis. Each half-hitch suture, or every other suture, should include vesical tissue or connective tissue attached to the bladder, so as to unite the vesical wall and the deepest layer of the vagina, thus preventing the formation of a dead space. When the suture approaches the cervical end of the wound, the needle is made to emerge upon the vaginal mucous membrane, and the vaginal wall itself is sutured in a reverse way from the cervix forward,

thus uniting the vaginal wound. One or two mattress sutures of chromicized catgut should be introduced to take off the strain from the continuous suture (Fig. 210). When the suturing is completed the two ends of the continuous suture are tied in the usual way.

When interrupted sutures are used, care should be taken to pick up the vesical wall or the connective tissue attached to it with the needle, so as to prevent a dead space forming between the bladder and vagina. Chromicized catgut is the best material for these interrupted sutures, as they resist absorption until healing is sound and yet do not require removal.

When the cystocele is large, care should be taken to detach the bladder from the anterior face of the cervix as far as the internal os or above it, and also to suture the vaginal wall to the cervix as high as the internal os. This necessarily elevates the base of the bladder and lessens the tendency to recurrence of the cystocele.

Stoltz's operation for the cure of cystocele is a very simple one and quickly performed, but for the typical case has inherent disadvantages. The operation consists in making a circular denudation embracing the larger portion of the prolapsed vaginal wall, then passing a suture around the denudation on the principle of the purse-string. The vesical wall is elevated as the circular suture is drawn tight. The defect of the operation consists in the fact that it shortens the anterior vaginal wall, thus tending to draw the cervix forward and to favor the production of retroversion of the uterus. In certain cases of cystocele in old women, in which the uterus comes down but little and in which it is desirable to do a rapid operation, the method of Stoltz offers this advantage.

When the tissues of the anterior vaginal wall have been crowded down in front of the child's head in labor and have subsequently become hypertrophied, there results a mass of tissue which is apt to prolapse into the vaginal orifice and modifies the normal appearance of the vaginal introitus, even if it produces no special symptoms. In such cases, if in addition there is a cystocele, the operation of resection of the anterior vaginal wall should be modified by dissecting away the hypertrophied tissue just beneath the urethra. This is best done by transverse dissection. The



FIG. 210.—ANTERIOR COLPORRHAPHY III.

Suturing the superficial layer of the vagina. One mattress suture has been introduced and tied; a second mattress suture is *in situ*.

resulting wound should be united with stitches passed anteroposteriorly. The result of the combination of this operation with the anterior colporrhaphy is a T-shaped line of union.

Continuous irrigation is the most convenient means of keeping the wound free from blood during the operation, but gauze sponges may be used by those who prefer the dry method.

When catgut sutures alone have been employed, they do not require removal. If one or more silkworm-gut sutures are used as tension sutures, they should not be removed for several weeks, until the wound of the perineal operation done in connection with the anterior colporrhaphy has soundly healed.

The after-treatment is discussed elsewhere.

PERINEORRHAPHY.

By perineorrhaphy is meant the repair of lacerations of the perineum by suture. The term is used to embrace operations done immediately after labor and those done at a subsequent date. The purpose of the operation is to restore the sacral or supporting segment of the pelvic floor to the normal. Lacerations which do not involve the sphincter ani muscle or the wall of the rectum are spoken of as incomplete, while those involving the sphincter ani or extending into the rectum are called complete lacerations. Many incomplete lacerations are much more extensive than those involving the sphincter.

History.—Authorities usually attribute the conception of the possibility of curing complete lacerations of the perineum to Ambroise Paré. He should be credited with having performed the operation. He states: "But if through the violence of the extraction the genital parts are torn so that the two cavities, the rectum and vagina, are torn into one, the tear must be stitched up, and the wound cured according to art. . . . I have thus cured two women living in Paris."¹ He does not say whether the operations were done immediately after labor or subsequently.

Perineorrhaphy, however, is referred to in an earlier work, supposed to be traditions handed down from the Middle Ages and edited by an unknown author.² It is stated therein that Trotula, a woman attached to the school of Salernum, who lived in the eleventh century, cured a laceration of the perineum by operation. "Postmodum rupturam intra anum et vulvam tribus locis vel quatuor suimus cum filo de serico."

Guillemeau, a pupil of Paré, operated upon one case of complete rupture of the perineum six weeks after labor, freshening the cicatrix with a curved bistoury.³ He used one figure-of-eight and two interrupted sutures, and cured the patient.

¹ Paré, Ambroise: *Opera Ambrosii Parei regis primarii et Parisiensis chirurgi*, etc., Parisiis, J. Dupuys, 1582, Liber xviii, chapter xxvii, p. 698. *Ibid.*, The works of that famous chirurgion, Ambrose Parey. Translated out of the Latine and compared with the French by Th. Johnson, etc. London, R. Cotes, 1649, Liber xxiv, chapter xxvii, p. 615.

² *Gynaeciorum, hoc est, de Mulierum tum Aliis, tum Gravidarum, etc.*, Basileae, per T. Guarinum, 1566, 257, chapter xx. *Gynaeciorum sive de mulierum affectibus commentarii Graecorum, etc.*, Basileae, 1586, vol. i, chapter xx, p. 105.

³ Guillemeau, Jacques: *Les Oeuvres de Chirurgie*, etc., Paris, N. Buon, 1612, Livre iii, chapter vii, p. 354.

The operation for complete tear was performed in France by De La Motte, Morlanne, Saucerotte, Noel and Dupuytren;¹ in England by Rowley;² and in Germany by Osiander and Dieffenbach. Dieffenbach began writing on injuries of the perineum in 1829.³ He followed the plan of making lateral incisions at each side of the perineum after suturing the rectovaginal septum. In 1837 he advised the primary repair of all lacerations of the perineum, including simple tears. Roux did much to popularize the operation for complete laceration, and published numerous successful cases.⁴ Mettauer, of Virginia, published a successful operation for the cure of a complete laceration of the perineum six months after its occurrence. The description of the operation is lucid and his conception of it is most intelligent. He used sutures of lead, which were fastened by twisting, as has been done subsequently with silver wire sutures.⁵

Bayer performed a primary operation for incomplete tear of the perineum in 1823.⁶ Churchill operated in a similar case in 1824,⁷ and Williams in 1827.⁸

Alcock performed the intermediate operation for incomplete laceration in 1820.⁹ In the course of his paper he suggested that cases of prolapse could be much improved if the perineum were repaired.

The secondary operation for the incomplete laceration of the perineum was first done as a means of cure in prolapse of the uterus. Fricke, of Hamburg,¹⁰ devised the operation of episiorrhaphy, and in 1835 he had operated four times with three successes. The character of the operation is indicated by its title. Dieffenbach (*loc. cit.*, 1837, p. 255) performed episiorrhaphy for prolapse of the uterus and combined it with a perineorrhaphy. Nick reported in 1838 that he had performed two secondary operations for incomplete laceration of the perineum.¹¹ Dieffenbach in his operative surgery, published in 1845, describes both the primary and secondary operations for incomplete and complete lacerations.

¹ Roux: "Memoir sur la Restauration du Périnée," etc., *Gaz. Médicale de Paris*, 1834, Tome ii, p. 17.

² Blundell, James: "Lacerations of the Perineum," *Lancet*, 1827-28, vol. ii, p. 709.

³ Dieffenbach, J. F.: "Chirurgische Erfahrungen," 1829, Bd. i, p. 64; "Sur la Rupture de Périnée," *Jour. complémentaire du Dictionnaire de Science médicale*, 1830, xxxviii, pp. 193-206; "Ueber die Zerreißung des Damms bei Frauen," *Medicinische Zeitung*, 1837, Bd. vi, p. 255.

⁴ *Clinique chirurgicale*, *L'Union médicale*, 1849, vol. iii, p. 247.

⁵ Mettauer, John P.: "A Case of Laceration of the Perineum," *Amer. Jour. Med. Sciences*, 1833, vol. xiii, p. 113.

⁶ Bayer, W.: "Cases of Ruptured Perineum Treated Successfully," *Edinburgh Med. and Surg. Jour.*, 1823, vol. xix, pp. 551-554.

⁷ Churchill, J. M.: "Case of Lacerated Perineum," *London Med. Repository*, 1824, vol. i, pp. 464-468.

⁸ Williams, C.: "Case of Laceration of the Perineum," *London Med. and Physic. Jour.*, 1827, vol. iii, pp. 101-102.

⁹ Alcock, Thomas: "On the Treatment of the Laceration of the Perineum in Parturition," *London Med. and Physic. Jour.*, 1820, vol. xlv, pp. 193-197.

¹⁰ Fricke, J. C. G.: "Episiorrhaphie, ou nouvelle Operation pour la Cure du Prolapsus de la Matrice," *Gaz. Médicale*, 1835, Tome iii, pp. 249, 618.

¹¹ "Beobachtung der vollkommenen Heilung einer nicht ganz neuen Dammraktur," etc. *Medicinisch. Correspondenzblatt des wuerttembergisch. aerztlich. Vereins*, Stuttgart, 1838, Bd. viii, pp. 301-303.

Baker Brown was the next surgeon to improve and popularize the operation.¹ His operation, like Fricke's, was an episiorrhaphy. Like his predecessors and contemporaries he failed to appreciate the real nature of the injury to the pelvic floor, and his operation did not reunite the torn structures, but rather hid them from view by securing union of the labia majora. His work, however, was of great value in inducing others to study perineal injuries, and thus led to improvement in both theory and practice. In 1866 Brown had done 112 operations on the perineum. Brown's operation was improved upon by Savage, who recognized the anatomic structures involved and extended the denudation up the posterior wall of the vagina. His operation has been developed more recently by Hegar and other German surgeons.²

Sims, Agnew, and Emmet were the next pioneers in this field. Sims followed the methods of operating practised by his contemporaries, his own contribution to the operation being the use of silver wire sutures.³ The work of Emmet, A. Martin, and Lawson Tait brings the development of the operation to our own period. The work of Emmet has been more fruitful in results than that of any one other surgeon, as he not only recognized that the separation of the torn muscles and fasciæ caused a loss of support of the sacral segment of the pelvic floor, but devised an operation to restore the parts to the normal, which was almost if not quite perfect in its results.⁴

General Considerations.—In order to appreciate the nature of lacerations of the perineum or sacral segment of the pelvic floor and the operations designed for their cure, it is necessary to understand the anatomy of the pelvis, and particularly the anatomy of the levator ani muscle and the pelvic fasciæ. The reader must be referred to standard treatises on anatomy and monographs upon the anatomy of the pelvic floor for detailed information. It must suffice to point out that the anterior or pubic segment of the pelvic floor, consisting of the anterior vaginal wall, bladder, uterus, uterosacral ligaments (and also the intestines contained in the pelvis), receive direct support from the perineum or sacral segment of the pelvic floor, and that the chief factors in affording this support are the levator ani muscle and the pelvic fasciæ. This muscle is most frequently injured in labor in its anterior portion just within the triangular ligament, but in extensive lacerations the injury may extend two or more inches up the vaginal canal in one or both sulci. The common types of injury are:

1. Laceration of the fourchette and introitus vaginæ.
2. Laceration of the fourchette and introitus vaginæ extending up one or both vaginal sulci.

¹ Brown, I. Baker: "Diseases of Women," 1854; "On Rupture of the Perineum and its Treatment," etc., 1852.

² Savage, Henry: "The Surgery, Surgical Pathology, and Surgical Anatomy of the Female Pelvic Organs," etc., second ed., London, 1870.

³ Agnew, D. Hayes: "Lacerations of the Female Perineum," etc., 1873.

⁴ Emmet, T. Addis: "A Study of the Etiology of Perineal Laceration with a New Method for its Proper Repair," Trans. Amer. Gynæc. Soc., 1883, p. 198.

3. Laceration of the rectovaginal septum involving the sphincter ani, extending a variable distance up the septum. The common type of this laceration is median. Exceptionally the laceration extends up one or both vaginal sulci. In rare instances the fetal head penetrates the rectovaginal septum and tears its way through the perineum, leaving the vaginal introitus intact. In such cases, as a rule, the sphincter ani muscle and rectal wall are torn. A very rare form of injury is the subcutaneous laceration of the sphincter ani muscle.

The structures involved in these various lacerations are as follows:

1. The slight median lacerations of the fourchette and introitus involve no structures of importance; when deeper, the transversus perinei muscles and the deep pelvic fascia or triangular ligament may be torn.

2. The same structures as in type one are involved, but in addition the fibers of the levator ani muscle which unite in the rectovaginal septum are torn,¹ and the anterior portions of one or both levator muscles are either torn through or they are detached from the lateral walls of the vagina and rectum. The fasciæ accompanying these muscles are also torn. The extent of the injury to the muscle or muscles depends upon the depth of the lacerations in one or both sulci. This is the type of laceration which destroys the supporting function of the pelvic floor and leads to rectocele, cystocele, and prolapse of the uterus—hernia of the pelvic contents. In certain cases the levator ani muscle is torn away from its attachment to the pubic bone instead of or in addition to being torn away from its attachments

¹ The anatomy of the rectovaginal septum is not so clearly described by anatomists as is desirable. The anterior portion of the levator ani muscle in the male is described, but scant reference is given to this portion of the muscle in the female.

Deaver ("Surgical Anatomy," vol. ii, p. 621) states that the most anterior fibers of the levator ani muscle "pass downward and backward around the lateral aspect of the prostate gland, to be inserted into the central tendon of the perineum, and have been termed the *levator prostatae*." And (*loc. cit.*, p. 672) "the levator ani muscle in the female differs from the corresponding muscle in the male only at its anterior portion, which closely embraces the sides and posterior wall of the vagina, whereas that part of the muscle in the male embraces the prostate gland." In a private communication Deaver states that the above portion of the levator ani muscle in the female is inserted in the central tendon of the perineum.

Morris ("Anatomy," 1895, p. 1099) in discussing the levator ani muscle says: "The anterior border crosses the sides of the prostate and is connected with the corresponding part of the opposite muscle by fibrous and smooth muscular tissue, which passes between the prostate and the rectum." "In the female the anterior fibers of insertion are connected with the sides of the vagina, interlacing with the longitudinal fibers of its muscular tissue without becoming actually inserted into the passage."

Charles Jewett ("Surgery of the Female Pelvic Floor," Brooklyn Med. Jour., Jan., 1906), in discussing the levator ani muscle, says: "The anterior lamella runs toward the perineal flexure of the rectum; a few of its fibers, passing in front of the bowel, become continuous through the intervention of tendon with the opposite transversus perinei muscle. A few go to the rectal sheath, others extend into the external sphincter ani, of which they form a part," etc.

All anatomists agree that the fibers of the levator ani muscle immediately posterior to those which have just been described are inserted into the sides of the rectum and unite with the sphincter ani. The next set surround the rectum and unite in the median line, the most posterior fibers being inserted as far back as the coccyx.

The fibers from the anterior border of the levator ani muscle which unite in the median line in the rectovaginal septum are in intimate connection with the rectovesical fascia, which is reflected from the triangular ligament over the upper and inner surface of the levator ani muscle. The triangular ligament, the rectovesical fascia, the sheaths of the vagina and of the rectum, the slips of muscle from the anterior border of the levator ani muscle which unite in the median line, and the insertion of the levator ani muscle into the sides of the rectum, are the structures with which the gynecologist has chiefly to deal in repairing extensive lacerations of the pelvic floor.

in the rectovaginal septum and rectal wall. This particular form of laceration is especially difficult to cure.

3. The chief injury is to the sphincter ani muscle with the resulting loss of control over the contents of the bowel. Usually this type of laceration is median and does not extend much, if at all, above the plane of the triangular ligament. Exceptionally the laceration extends up one or both sulci, and thus becomes a combination of types two and three, involving both loss of control over the bowel contents and loss of support from the pelvic floor. In some cases the sphincter ani may be torn subcutaneously without an external wound.

A variation of type two is a very common and interesting form of injury of the pelvic floor. Upon examination the skin perineum and posterior commissure will be found intact, and the mucous membrane of the vagina may likewise present



FIG. 211.—THE LEVATOR ANI MUSCLE (Kelly).

no scars, and yet the patient may have all the symptoms of lack of pelvic support. Upon inspection the anus will be found to have dropped downward and backward, the skin perineum will be of greater extent than normal, and the introitus vaginæ will be gaping. The injury consists of the submucous rupture of the pelvic fasciæ and of the slips from the levator muscle which unite in the rectovaginal septum, and also the separation laterally of the levator muscles from the vagina and rectum. Emmet likened this condition to the mouth of a bag without the running-string. In discussing this condition he laid special stress upon the rupture of the fasciæ and the loss of support of the pelvic vessels and said very little about the muscles, in which respect alone his teachings differ from those most approved today.

It would be well if every surgeon before practising operations for the cure of

lacerations of the perineum could serve an obstetric apprenticeship and thus learn the nature of the lacerations from a study of their details immediately after labor.

The **symptoms** of laceration of the perineum depend entirely upon the structures involved. A superficial laceration of the fourchette and posterior commissure probably causes no symptoms whatever. At the most the patient may be able to appreciate the fact that the orifice of the vagina is somewhat enlarged. A deeper laceration of this type (type one) involves the transversus perinei muscles and the constrictor vaginae. This gives rise to more or less gaping of the introitus vaginae, but unless the deep pelvic fascia is also involved, it probably produces no symptoms. When the laceration is sufficient to involve the triangular ligament, there are minor symptoms of loss of support.

When the laceration belongs to type two, which involves not only the fourchette and introitus vaginae but extends up one or both vaginal sulci, the anterior fibers of the levator ani muscle which unite in the rectovaginal septum are torn and the levator itself is separated on one or both sides from its attachment to the vagina and rectum. This form of laceration causes positive loss of support and produces marked symptoms. The patient feels that the contents of the pelvis are not supported and complains of pelvic tenesmus or "bearing down." Depending upon the extent of the injury and the length of time it has existed, the posterior vaginal and anterior rectal walls evert (rectocele), the anterior vaginal and vesical walls roll out (cystocele), or the uterus becomes prolapsed, or these three secondary results of this type of laceration occur together. This is the type of laceration which leads to procidentia or hernia of the pelvic contents, and the patient suffers symptoms quite similar to those of hernia in any other region. Subinvolution of the vagina is one of the early consequences of this type of laceration, and later there is overstretching of the vaginal walls. The laceration of the pelvic fasciae deprives the blood-vessels of their normal support, with the result that there is passive congestion of the perivaginal tissues. In the more extreme cases the patient has the sensation that the contents of the pelvis are escaping through the vulva. In the minor cases, on the other hand, there may be overaction of the intact portion of the levator muscle, giving rise to nervous reflexes quite similar in their nature to the results of muscle-strain in the eyes. Backache is a common symptom. Partial incapacity for active work is the rule.

In type three, which involves the laceration of the sphincter ani muscle and more or less of the bowel wall, the chief and usually the only symptom is loss of control over the bowel contents. Not infrequently the ends of the torn sphincter muscle are caught in scar tissue, so that there may be partial or even fairly good control. The control is more apt to be perfect so far as the fecal contents of the bowel is concerned than is true of gases. When the bowels are constipated, there is far better control than when they are loose, so that patients incline to keep themselves constipated. In other cases the laceration leads to a more or less persistent diarrhea, which is promptly cured by the repair of the lesion. In the rare cases of complete tear of the perineum in which the laceration extends up one

or both sulci and causes loss of pelvic support, the symptoms of hernia are added to those of rectal incontinence. Because of the tissues involved in complete rupture of the perineum procidentia is almost never seen as a complication.

Diagnosis.—The diagnosis of injuries to the perineum offers few difficulties, provided the examiner is familiar with the normal anatomy of the pelvic floor. The examination is best conducted with the patient in the dorsal position. In type one, upon separating the labia the posterior commissure is seen to be torn and there may be slight gaping of the introitus vaginæ. If the patient is requested to strain or bear down, the posterior wall of the vagina is not forced into the introitus. Upon passing two fingers within the vagina the levator ani muscle will be found intact laterally, and upon pressing the fingers posteriorly the normal support afforded by the fibers of the levator ani muscle which unite in the middle line and by the pelvic fascia will be recognized. Inspection will show that the anus occupies its normal relation to the pubic arch and that it has not dropped downward and backward as a result of injury of the levator muscle. The cleft between the nates is normal and not flattened, as is true when the levator ani muscle and the pelvic fasciæ are torn.

In type two the vaginal orifice is gaping. When the posterior commissure is not torn the fourchette is intact and the skin perineum is elongated anteroposteriorly to even twice its normal extent. If the patient is asked to strain or bear down, the posterior vaginal wall rolls out, or both posterior and anterior vaginal walls roll out. The anus is seen to have dropped downward and backward, so that the distance from the anus to the arch of the pubes may be twice the normal. The cleft between the nates is flattened. Upon introducing two fingers within the vagina the levator ani muscle is found separated laterally upon one or both sides and the resistance normally afforded by the levator ani muscle and the pelvic fascia is wanting. In detail the remaining conditions to be observed differ greatly. The scars resulting from the laceration may be seen extending up one or both sulci. In the more extreme cases rectocele, cystocele, and prolapse of the uterus are present. In the variation of type two, in which the injury to the pelvic fasciæ and the levator muscles is submucous in its nature, no scars can be recognized, because none are present. In these cases the skin perineum is always elongated; otherwise the diagnostic signs are much the same as when the laceration has involved the skin and mucous membrane as well as the deeper structures. This type of laceration has been described by Kelly as a "relaxed outlet."

When the sphincter ani muscle and the rectal wall are involved in the injury the diagnosis is evident upon inspection of the parts. The rectovaginal septum is torn and the torn sphincter may be felt with the ends of the torn muscle retracted upon each side of the laceration, their location being easily recognized by the pits which form as a result of the retraction of the muscle. In exceptional cases the sphincter ani muscles may be torn without laceration of the skin perineum. In such cases the diagnosis must be made by the evident loss of control over the bowel contents and by palpating the sphincter muscle in order to recognize its broken continuity.

IMMEDIATE PERINEORRHAPHY.

The immediate repair of lacerations of the perineum offers many advantages to the patient and should be performed in all cases unless the condition of the patient at the conclusion of labor renders an operation inadvisable. Such obstetric complications as puerperal eclampsia, postpartum hemorrhage, collapse or great prostration of the patient, forbid operation. Very marked edema, extensive bruising, or ecchymoses of the genitalia, are further valid grounds for postponing operation. Under all other conditions the injuries to the pelvic floor should be repaired immediately after labor or within twenty-four hours of its completion, when proper assistants can be summoned. If the labor has been terminated at night, with the attendants tired out and when proper assistants cannot be obtained, it is far better to postpone the operation for a number of hours than for the obstetrician to attempt it unaided or with unskilled assistants.

Recent External Superficial Tear.—In the simplest form of laceration, described as type one, the closure of the rent is not imperative; but even in these simple cases it is advisable as closing an avenue for infection, and also as guarding the practitioner from blame in case he has underestimated the extent of the lesion.

Operation.—The parts should be prepared for operation by cleansing them with soap and sterile water and douching with bichlorid solution (1:4000) or other suitable germicidal solution. The sterilization of the hands of the operator and assistants and of the instruments and suture material should be the same as for all operations. The operation may be done with the patient across the bed in the lithotomy posture, but it is far better to transfer her to an operating table. General anesthesia is always desirable. The legs may be held by an assistant, but preferably by leg-holders. The use of the Kelly perineal pad permits the employment of irrigation and facilitates the operation. The necessary instruments are a needle-holder, medium-sized curved needles, scissors, dissecting forceps, artery forceps, catgut and silkworm-gut sutures and silk for carriers. The labia are held apart by the assistants, thus exposing the torn fourchette and introitus. It is best to begin the suturing at the upper end of the laceration on the posterior vaginal wall. Silkworm-gut possesses distinct advantages in domestic practice, and if catgut is employed, heavy catgut should be avoided. The sutures should be placed less than a centimeter apart. The general principles applicable in all plastic work—that the suture when tied should form a circle or approximately a circle in the tissues—should be followed, as this brings the surfaces to be approximated into neat apposition. The needle should be introduced about half a centimeter ($\frac{1}{2}$ inch) from the edge of the laceration. Each suture should be tied as soon as placed, care being taken to avoid tension. The rule to avoid tying sutures too tightly is of special importance just after labor. Many a failure to secure good union has been due to strangulation of the tissues by tight sutures. For simple lacerations, usually from three to six deep sutures will be necessary. Such superficial sutures as may

be necessary should be placed to secure neat approximation of the skin perineum.

Recent Internal Tear and Combined External and Internal Tear.—In the more serious lacerations described as type two, which extend up one or both vaginal sulci and which usually involve the introitus and perineum, the suturing should begin at the upper end or ends of the laceration in the vaginal sulci. The same instruments are needed as for type one, and in addition a Sims speculum or a vaginal retractor may be of service. It is well in these cases to introduce a gauze sponge in the vagina above the field of operation to prevent the lochial discharges from flowing over the wound—to be removed after the suturing is completed. The same principle in placing the sutures is to be followed as described for the repair of superficial lacerations. If there is much contusion, it is well to embrace more tissue in the sutures than would be necessary in sound tissue. The structures involved should be accurately estimated in order that the suturing may accomplish the restoration of the pelvic floor to the normal; especially must the injury to the levator ani muscle upon each side and its connection to the rectal and vaginal walls and its union in the rectovaginal septum be restored. If the laceration extends far up the vagina, its upper portion, as a rule, involves only the vaginal wall, and the sutures of the upper end need not be very deep. The portion involving the levator muscle (about 1 inch within the vagina) should be very carefully sutured. The needle should take a firm hold on the levator muscle, coming out near the bottom of the torn sulcus. It should be reintroduced upon the median side of the tear, pick up the tissues on the rectal wall, and emerge from the vaginal mucous membrane at a point corresponding with the point of entrance. This is the so-called V-shaped suture of Emmet. In order that the suture shall draw the structures back into the pelvis the point of the needle is directed in such a manner that it emerges from the bottom of the sulcus at a lower plane in the pelvis than its point of introduction. When enough sutures have been introduced to close one sulcus, the other sulcus, if torn (as is usually the case), is sutured in a similar manner, leaving the laceration through the introitus vaginæ to be closed. The suture passed just within the hymen (plane of the deep perineal fascia) should pass through the anterior border of the levator ani muscle upon one side, pick up tissues in the median line, then pass through the anterior border of the opposite levator ani muscle and emerge from the vaginal mucous membrane just within the hymen, so that when tied the torn slips of the levator ani muscle shall be brought into apposition. The next suture is passed at the plane of the hymen and brings the torn edges of the deep fascia into apposition. One deep and several superficial sutures suffice to close the laceration through the skin perineum and to unite the torn transversus perinei muscles. If silkworm-gut is used as suture material, it may be threaded either directly into the eye of the needle or introduced by means of a needle and carrier. Its use is facilitated by soaking it in hot water to soften it. For superficial sutures light-weight catgut is preferable. For the average laceration of this type, in addition to the catgut sutures, eight silkworm-gut sutures will be re-

quired and in extensive ones a much larger number may be necessary. When the tissues are ragged, it is at times desirable to trim the ragged edges with scissors before introducing the sutures.

It was formerly the rule to close this form of laceration by sutures passed through the skin surface of the perineum. The result of this method of suturing is apt to be that the separated levator ani muscles are not included in the sutures, and that while the skin perineum is restored, the supporting power of the pelvic floor is lost.

Recent Complete Laceration of the Rectovaginal Septum.—The immediate repair of complete rupture of the rectovaginal septum is even more important than that of the other types of laceration. The same instruments are needed. The first step in the operation is the closure of the rent in the bowel, which is effected by placing light-weight interrupted catgut sutures, introduced from the rectal surface and beginning at the upper end of the tear. Each suture pierces the margin of the mucosa and appears on the septum half a centimeter ($\frac{1}{2}$ in.) from the edge and enters the septum on the opposite side, coming out again on the mucosa. Each suture is tied as it is introduced, the knot being within the rectum. They are placed 7 mm. ($\frac{1}{4}$ in.) apart. As the anal border is approached, it is desirable to use silkworm-gut for alternate stitches. Enough sutures are introduced to close the rent in the rectum down to and including the border of the anus. The laceration is now reduced to one of the types already treated and is closed in the same manner, with the exception of the treatment of the torn sphincter ends. Two light-weight (No. 1) catgut sutures should be passed through each end of the torn sphincter to approximate this structure. These sutures should be reinforced by two silkworm-gut sutures, which enter on the skin surface of the perineum, pass through the sphincter itself, traverse the perineal septum, and emerge through the skin perineum upon the opposite side, passing through the other end of the torn sphincter in their course. When tied these sutures hold the torn sphincter ends in apposition until union takes place. When properly performed this operation is uniformly successful if infection of the perineum does not occur. The immediate operation probably succeeds in 90 or 95 per cent. of cases.

The reader is referred to the illustrations of the secondary operations upon the perineum, which demonstrate the course of the sutures employed in the *primary* as well as the *secondary* operation. A study of these illustrations will greatly assist in making clear the foregoing description of the primary operation.

The after-treatment of these cases is the same as for the secondary operation upon the perineum and will be described in that connection.

What has been described as the *intermediate operation* for injuries of the perineum has been performed at any time from one week after labor until cicatrization has resulted. Barton Cooke Hirst has recently advocated this plan in preference to the immediate operation, and claims that on the whole his results are better than by the method which has been recommended. As a further advantage of postponing the operation until a week after labor, lacerations of the cervix

can be repaired at the same time. This particular point of advantage is undoubted but on the whole the immediate operation is to be preferred, as it shortens the time of convalescence and saves the patient from a week's contemplation of an operative procedure.

SECONDARY PERINEORRHAPHY.

The conditions present in old lacerations of the perineum differ so widely, owing to variations in the structures torn or overstretched in labor, the length of time which has elapsed since the injury, and the nature of the secondary results which have ensued, that for clearness it will be necessary to describe typical operations, and then to refer to the variations which must be made to adapt the operative procedure to the actual indications in the particular case.

The Superficial External Tear.—This form of laceration, which has been



FIG. 212.—HEGAR'S OPERATION.

called type one, seldom calls for secondary perineorrhaphy unless there exists some other indication for operation. When the laceration is of sufficient depth to involve the transversus perinei muscles and triangular ligament, it results in a gaping introitus. Under these conditions, or if a painful scar be present, the secondary operation is called for. It is my own practice, when operating upon the uterovaginal canal, to repair all lesions which may exist, and hence operation in this variety of laceration is often done in connection with such operations as trachelorrhaphy, or amputation of the cervix, when it would not be considered advisable to subject a woman to the operation for this condition alone. As the form of laceration is median and the levator ani muscle is not involved in the injury, the operation indicated is the type advised by Savage and developed by Hegar (Fig. 212). The hymen or its remains is picked up just below the orifice of the vulvovaginal glands on each side

with a special tenaculum shaped like a shepherd's crook. An assistant upon each side makes traction upon these, which separates the vaginal orifice and exposes the field of operation. A denudation is made of the posterior commissure and lower portion of the posterior vaginal wall, which is roughly triangular in shape, the base of the triangle being a curved line between the two tenacula, the convexity of the curve being in the direction of the anus, the apex of the triangle being upon the posterior vaginal wall. The surface to be denuded may be outlined with a scalpel or the tissue may be removed with scissors under the guidance of the eye without the preliminary use of the knife. The original scar should be excised and the triangle should extend sufficiently up the posterior vaginal wall to allow the tissues to come naturally in apposition. The object of the operation is to restore

the perineum to its original contour and to reunite the triangular ligament or deep pelvic fascia and also the transversus perinei muscles. When the denudation is complete, the wound should be closed with sutures. The suturing should begin at the upper angle of the denudation. Two or three interrupted medium weight (No. 2 or No. 3) catgut sutures suffice to bring the edge of the vaginal mucous membrane in apposition. A deep silkworm-gut suture should be passed at the plane of the hymen, which is the plane of the deep pelvic fascia. The principle universally applicable in plastic surgery, that when two surfaces are to be united the needle must be made to describe a half-circle behind each surface, so that when tied the suture will form a more or less perfect circle in its course through the tissues, is applicable here; but care must be taken that the needle does not penetrate the deep fascia too close to the pubic rami, as in this event, when the suture is tightened, it will not approximate the surfaces because of the unelastic character of the attachment of the pelvic fascia to the pubic rami. Should the inexperienced operator find that the suture when tightened will not approximate the tissues, the suture should be removed and less tissue should be embraced in it. A second deep suture should be passed just outside the hymen to catch the retracted transversus perinei muscles. The remainder of the wound in the fourchette and skin perineum can be closed with a few interrupted light weight (No. 1 or No. 2) catgut sutures.

In passing sutures in plastic operations upon the vagina and perineum, the needle should be introduced about 5 mm. ($\frac{1}{8}$ in.) from the margin of the wound and emerge upon the opposite side at a corresponding point. When tying the sutures, sufficient traction should be made to bring the parts into neat apposition without tension. Tight sutures interfere with the circulation or strangulate the tissues and promote infection and suppuration.

The after-treatment is discussed elsewhere.

Internal and External Incomplete Lacerations of the Perineum—The Relaxed Vaginal Outlet.—The characteristics of the various forms of injury to the perineum embraced under this title have been classified as type two. This variety of injury to the pelvic floor was very imperfectly appreciated until recent years. Savage made the first advance in the study of the nature of the lesion by calling special attention to the anatomy of the parts involved and by devising an operation which was an improvement upon that of his predecessors, and which was the basis of the operation which has been developed by the German school and which is known as Hegar's operation. It remained for Emmet to appreciate the fact that the function of the sacral or supporting segment of the pelvic floor could be destroyed by injury and laceration of the pelvic fascia without any laceration of the skin perineum, and to devise a satisfactory operation to cure the injury. Prior to 1883, when Emmet wrote upon this subject, the severity of the laceration of the perineum was estimated by the extent of the tear in the direction of the anus and rectal wall,—in other words, by the depth of the tear through the fourchette and introitus vaginæ. Emmet's views were so radically different from those held by his contemporaries that the subject was again studied, especially recent perineal

injuries, and the correctness of his claims became apparent. About all that has been added to our knowledge of the subject by others is a greater appreciation of the injury to the levator ani muscle in addition to that of its fascia, which has been insisted upon by more recent writers.

Two types of operation for the cure of this form of laceration are in vogue at the present time. In one (Hegar's) the denudation is median, extending up the posterior vaginal wall, and the attempt is made by a single row of sutures to restore the torn structures to the normal. In the other (Emmet's) the denudation is

median at the introitus vaginæ and follows the vaginal sulci, the line of sutures being in the form of a Y. The nature of the original lacerations, together with the anatomic and mechanical problems involved, render the Emmet procedure far superior, in my judgment, to that of Hegar.

Before proceeding with the operation in a particular case, the exact conditions present should be carefully studied. The extent of the laceration of the deep pelvic fascia, the laceration of the slips of the levator muscle which unite in the rectovaginal septum, the separation of the levator from the vaginal and rectal walls upon one or both sides, the separation of the levator muscles laterally, with laceration of the fascia permitting the rectum and posterior vaginal wall to roll out through the introitus vaginæ, the existence and size of the rectocele or overstretched posterior vaginal and anterior rec-



FIG. 213.—PERINEORRHAPHY.

The field of operation is exposed for denudation.

tal walls, the relation between the posterior vaginal and anterior rectal walls,—all these are questions which must be investigated before a thoroughly satisfactory operation can be performed. In order that the operation may be satisfactory, it must be so varied in the particular case as to restore the anatomic conditions approximately to the normal.

Operation.—A careful study of the illustrations will greatly assist the reader in appreciating the description of the operation. The first step is to outline the limits of the denudation. The hymen or its remains is picked up on each side

just below the orifice of the vulvovaginal gland with a *shepherd's crook*, each of which is held by an assistant. A rather heavy double tenaculum forceps is then used to catch the skin of the perineum just below the fourchette and below the limits of the denudation upon the skin. The weight of this forceps tends to retract the perineum and facilitates the escape of the water used in irrigation. With a light weight double tenaculum forceps the posterior vaginal wall is picked up in the middle line at a point which shall be between 5 mm. and 1 cm. ($\frac{1}{2}$ and $\frac{2}{5}$ in.) within the hymen at the completion of the operation. This point is selected with reference to the size of the rectocele. If the rectocele is large, the posterior vaginal wall is necessarily over-stretched, and it is desirable to remove by denudation a greater portion of the vaginal mucous membrane than when no rectocele exists.

The field of operation is now exposed, and, roughly speaking, it may be said that three triangles are exposed—an external one between the two shepherd's crooks and the forceps attached to the skin perineum, and two internal ones, the base of each being a line between the shepherd's crook and the tenaculum forceps, each running up one vaginal sulcus (Fig. 213). The tissues to be removed may be outlined with a knife, the excision extending downward and outward from the shepherd's crook to the bottom of the laceration in the skin perineum and then upward and inward to a corresponding point upon the opposite side. An incision is then made upon one

lateral vaginal wall extending up the sulcus as far as in the particular case is necessary. A corresponding incision is then made upon the posterior vaginal wall extending from the incision already made to the central tenaculum forceps. The triangle in the other sulcus is then outlined in a similar way. The tissue so outlined is now removed by means of the Emmet right-and-left curved scissors. With a little practice this is done with great facility. The tissue is picked up with a rat-tooth dissecting forceps and a strip is denuded with the



FIG. 214.—PERINEORRHAPHY.
The denudation is completed.

scissors. Successive strips are removed until the denudation is complete. Attention should be paid to the removal of the mucous membrane lest islands of undenuded mucous membrane be left at different points on the vaginal wall. Should this oversight occur, the islands of mucous membrane may give rise either to early suppuration or to late mucous cysts. With experience the operator will cease to outline the tissues to be removed with a knife and do the whole operation with scissors under the guidance of the eye. Fig. 214 gives a good illustration of

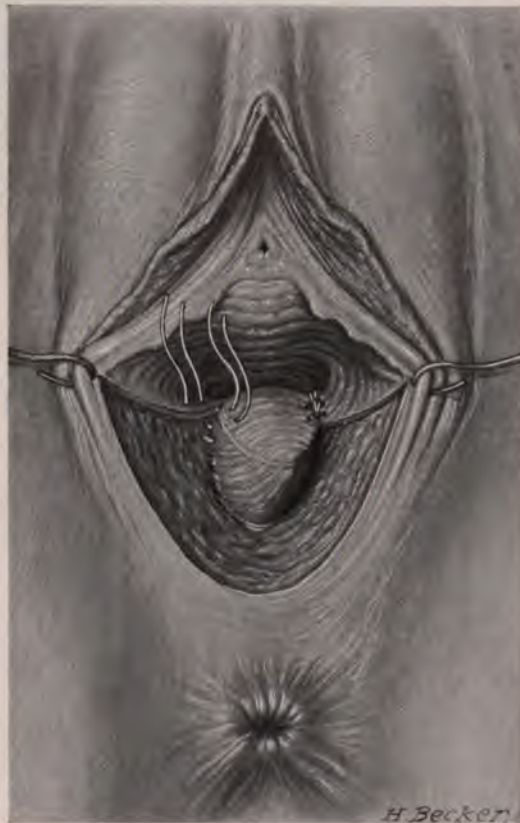


FIG. 215.—PERINEORRHAPHY.

Two superficial sutures have been introduced in the upper end of each sulcus, two of which are tied.

Fig. 214 gives a good illustration of the appearance of the vaginal outlet at the conclusion of the denudation. In the average case the denudations extend from 2 to 3 cm. ($\frac{4}{5}$ in. to $1\frac{1}{2}$ in.) up each sulcus of the vagina. When a large rectocele exists, they may extend much higher with advantage.

The suturing is begun at the upper end of one sulcus. The upper sutures usually include only the vaginal wall, and to avoid the necessity of their removal they should be of medium weight (No. 2 or No. 3) catgut. The sutures are most conveniently introduced by means of a full curved, light weight needle (the Kelly perineal needle) armed with a carrier through which the catgut is threaded. Each suture should be tied as it is introduced (Fig. 215). Two or three sutures usually suffice to approximate neatly the upper end of the sulcus. Usually two sutures are now introduced to attach the posterior vaginal wall to the levator ani muscle. When a rectocele exists, these sutures are employed to pick up the loose tissues of

the rectocele and to roll them back into the pelvis by attaching them to the levator ani muscle, at the same time elevating the posterior wall of the vagina, so that at the completion of the operation it shall lie in contact with the anterior vaginal wall. The first of these sutures may be of catgut. The second should be of silk-worm-gut and act as a tension suture. When operating in the left sulcus, these sutures are introduced as follows: The lateral vaginal wall is pushed within the pelvis with two fingers of the left hand and at the same time elevated toward the pubic arch. This maneuver is practised so that when the suture is passed it

will tend to fasten the lateral vaginal wall to the levator muscle at a higher plane within the pelvis. The needle is introduced 5 mm. ($\frac{1}{4}$ in.) from the margin of the wound and is passed directly through the levator muscle so as to catch a firm hold on the muscle and its fascia. It is then brought out into the sulcus about 1 cm. ($\frac{2}{5}$ in.) below the lateral margin of the wound. The needle is then introduced into the loose tissues of the rectocele at a plane considerably below the point of its emergence, and made to pass along the sides of the rectocele without penetrating the rectal wall until it emerges upon the posterior vaginal wall at a point corresponding with its point of entry. The effect of these sutures when tied is to draw the rectocele back into the pelvis and to elevate the posterior vaginal wall and attach it to the levator muscle.

The method of introducing the suture is a variation from the original V-shaped suture of Emmet and is believed to give a better "lift." The Emmet suture emerges at the bottom of the sulcus, the two sides of the V being of corresponding length. If the vaginal wall is not pushed within the pelvis, and if, on the contrary, it is drawn forward toward the operator, the effect of the suture may be to roll the posterior vaginal wall out, instead of rolling it back within the pelvis. Two sutures passed after this manner are usually sufficient to dispose of the rectocele and to attach the posterior vaginal wall to the levator ani muscles. The last or "tension" suture should be just within the border of the levator ani muscle. The location of this muscle should always be determined before placing

these sutures. Fig. 216 illustrates the mode of passing the sutures. The denudation in the opposite sulcus is now sutured in a similar manner.

The crown suture is next passed. This should be of medium weight catgut and is a superficial suture throughout (Fig. 217). It is passed first through one lateral vaginal wall, the tip of the posterior vaginal wall, and then through the opposite vaginal wall. This suture is about $\frac{1}{2}$ cm. ($\frac{1}{2}$ in.) within the hymen, which is about opposite the anterior border of the levator muscle. The next suture



FIG. 216.—PERINEORRHAPHY.

Two sutures introduced in each sulcus to roll back the everted vagina and to attach the rectocele (rectal wall) to the rectovesical fascia and levator ani muscle. The two sutures in the left sulcus are tied.

should be of silkworm-gut, and its special purpose is to approximate the anterior borders of the levator muscle covered with their fascia, so as to obtain fascial union, and in this way imitate the union of the slips from the levator ani muscle which unite in the rectovaginal septum (Fig. 217). The needle is introduced through the lateral vaginal wall just within the hymen, and passes rather



FIG. 217.—PERINEORRHAPHY.

Noble's method of closing the vaginal outlet and securing union of fasciæ covering the anterior borders of the levator ani muscle. The upper superficial "crown" stitch is ready to tie. The stitch a, a' is passed through the anterior border of each levator ani muscle (indicated by b, b') deep in the sulci. When tied it will insure fascial union. The lower suture when tied will unite the torn deep pelvic fascia—triangular ligament.

the skin perineum. Silk is usually used for this purpose, as these external sutures are usually removed at the end of a week, whereas the internal ones remain for two weeks. If superficial sutures are needed they should be of light weight (No. 1 or No. 2) catgut (Fig. 219).

¹ Holden, Gerry R.: "Perineorrhaphy by Uniting the Borders of the Levator Ani Muscles," Amer. Jour. Obst., 1905, vol. lii, No. 4, p. 497.

superficially from before backward and from above downward for about 1 cm. It is then made to pass deeply into the left sulcus until the anterior border of the levator muscle is caught in the depths of the sulcus. This maneuver may be facilitated by picking up the border of the levator muscle with a dissecting forceps (Fig. 218). The needle is then brought out of the sulcus and is made to catch up some tissue at the bottom of the wound. It is then passed into the right sulcus deeply enough to catch the anterior border of the levator muscle, after which it is passed through the tissues of the right side in a manner corresponding to the left. When tied, this suture will approximate the anterior borders of the levator ani muscle. This procedure may be modified by burying a catgut suture to approximate the anterior borders of the levator ani muscle, or a silkworm-gut suture may be passed in the form of an 8.¹ The next silkworm-gut suture is introduced at the plane of the hymen to approximate the torn deep pelvic fascia. One or two deep sutures suffice to approximate the wound in

The operation is completed by douching out the vagina to remove any blood or blood-clots, by cutting off the ends of the silkworm-gut, leaving them about three inches long, this portion of the suture being turned into the vagina out of the way. A small piece of gauze is then placed in the lower portion of the vagina to serve as a drain. The external wound is powdered with sterile boric acid, and the wound is dressed with a sterile pad made of cotton covered with gauze.

The operation described differs from the typical Emmet operation in several particulars. In the typical Emmet operation the crown stitch is inserted in the skin external to the hymen, passes through the vulvovaginal junction, skips

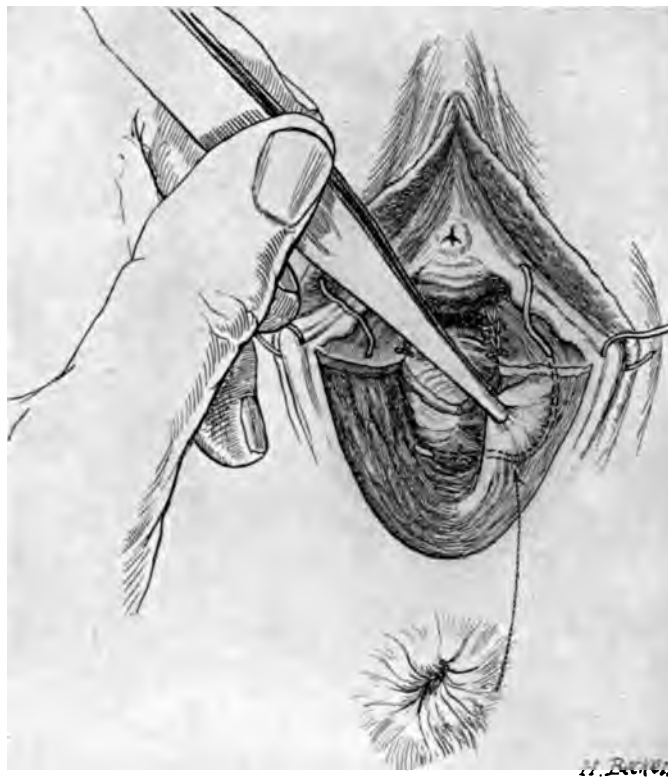


FIG. 218.—PERINEORRHAPHY.

The anterior border of the levator ani muscle is drawn forward and toward the median line as the suture is passed through it.

the tissues in the sulcus, catches the tip of mucous membrane upon the posterior vaginal wall, and is brought out through the vulvovaginal border upon the opposite side in a corresponding way. The result of tying the crown stitch introduced in this manner tends to draw the posterior wall of the vagina between the lateral structures which should be united at the vaginal outlet, and in so much tends to prevent union of the borders of the levator ani muscle and of the deep pelvic fascia. As a consequence, the result of the operation is often to give a somewhat gaping introitus; and for the same reason it fails in many cases to furnish adequate support because

the lateral structures at the vaginal outlet are not brought together in the median line. The operation which has been described may be said to combine the advantages of the Emmet operation with those of the Hegar operation. The denudation of the two sulci and the sutures introduced in the sulci are made use of to roll back the loose tissues of the rectocele within the vagina and to fasten the posterior vaginal wall and anterior and lateral rectal walls to the levator ani muscle. A

firm introitus is also secured, as is the case with the Hegar operation. What is novel in the operation as I have practised it is the securing of fascial union of the anterior borders of the levator ani muscle in the median line,¹ in order to imitate the normal union of the slips of muscle from the levator ani which unite in the median line in the rectovaginal septum. This restores the vaginal outlet more nearly to the normal than is true of the Hegar operation. Also the method of introducing the sutures in the sulci is believed to be superior to the V-shaped suture of Emmet.

The foregoing description of secondary perineorrhaphy is that of a typical case having a well-marked laceration without any of the conditions being extreme. In order to complete the description it will be necessary to consider a number of variations from the type.

Detachment of the Posterior Vaginal from the Rectal Wall—

False Bursa.—In certain cases the vaginal wall becomes detached from the rectal wall or its attachment is



FIG. 219.—PERINEORRHAPHY.

Schematic drawing of the result of the modified Emmet operation. The drawing magnifies the wound in the skin perineum. In practice the intravaginal sutures are not visible when the operation is completed.

by very loose connective tissue. Not infrequently a false bursa forms between the vaginal and rectal walls for the same reason that a false bursa forms in other portions of the body. In dealing with such a case the typical operation should be modified. The tongue of vaginal mucous membrane left upon the posterior wall should be detached from the rectum, which can readily be done with a few snips of the scissors and pressure with the finger or gauze. When the condition

¹ Noble, Charles P.: "A Contribution to the Technic of Operations for the Cure of Laceration of the Pelvic Floor in Women," *Amer. Gynec. and Obstet. Jour.*, April, 1897.

is not extreme, the loose tissues in front of the rectum can be caught up with the usual sutures which are placed in each sulcus. When the conditions are more extreme and this expedient will not answer, it is best to bury a row of catgut sutures between the vaginal and rectal walls, catching the fascia at the sides and uniting these with the anterior rectal and posterior vaginal walls. When this is done, the operation proceeds in the usual way.

Detachment of the Levator Ani Muscle from the Ramus of the Pubes.—

This injury of the levator ani muscle and of the supporting segment of the pelvic floor is one which is very difficult to remedy. Logically the plan of operation would be (after making the denudation in accordance with the other injuries of the pelvic floor) to separate the lateral vaginal wall from the pubic bone, then to make a dissection exposing the anterior portion of the levator ani muscle and to search for the retracted ends of the torn muscle. These should then be sutured to the periosteum of the ramus of the pubes. In practice this is very difficult to carry out, and it is usually better to make use of the intact portion of the levator ani muscle in carrying out the usual operation. The result, however, not infrequently is a partial lack of support upon one side at the vaginal outlet.

Perineorrhaphy for Procidentia Uteri.—The operation upon the perineum which is one of the operations necessary for the cure of prolapse of the uterus, and especially of prolapse of the uterus and vagina, must differ in several respects from the typical operation. In the more extreme cases not only is there a rectocele and a cystocele, but also the lateral walls of the vagina are detached from their connections. The problem before the operator is not only to restore the perineum to the normal, but also to reattach the posterior vaginal wall to the rectum and to reattach the lateral walls of the vagina. When the various operations necessary to cure a procidentia are done at one sitting, it is at times impossible in the extreme cases to fulfil all of the indications. As a rule, it suffices to extend the denudation in the vaginal sulci, so that they extend 4 cm. ($1\frac{3}{4}$ in.) to 5 cm. (2 in.) instead of from 2 cm. ($\frac{1}{2}$ in.) to 3 cm. ($1\frac{1}{2}$ in.). In this way the lateral vaginal walls can be reattached in the lower two-thirds of the vagina. In these cases it is also necessary to reattach the rectum to the vagina, as has been described on page 406. Under these circumstances the lesions present in the upper third of the vagina have received no attention. When a hysterorrhaphy is added to the plastic work, in at least 95 per cent. of the cases the result secured is entirely satisfactory. In the small remaining percentage of cases at times it is necessary to do a secondary operation upon the posterior and lateral vaginal walls to restore the parts to the normal. This is most apt to be necessary in cases in which there is a posterior enterocele and in cases in which the uterosacral ligaments have been very greatly overstretched. In this particular group of cases it is best to precede the hysterorrhaphy with intraperitoneal shortening of the uterosacral ligaments.

How to Prevent Scars at the Vaginal Introitus.—In the effort to secure a firm vaginal introitus and adequate support to the pelvic viscera through fascial union of the anterior borders of the levator muscle, there is a risk that the surgeon

may do too much, and as a result secure an inelastic vaginal outlet with a more or less firm transverse scar just within the hymen. In married women approaching or past the menopause this may be a source of subsequent discomfort. The denudations upon the lateral vaginal walls must not be made too far forward toward the pubic arch and the anterior borders of the levator ani muscle must be caught well down (deep) in the sulci. If the mistake is made of catching the

levator ani muscle too near its pubic attachment, the resulting vagina is too narrow and inelastic. The rule in plastic surgery that the parts to be united must come together without tension is very important in this connection. The central tongue of mucous membrane left upon the posterior vaginal wall must not be too narrow, as otherwise its nutrition may be cut off by the various sutures and a slough with subsequent scar formation result.

The one advantage of the flap-splitting operation introduced by Lawson Tait and developed by Sanger and others is that no tissue is sacrificed and the parts come together without tension. In elderly women this method of operation would on this account have definite advantages did it afford a satisfactory means of disposing of a rectocele and of securing fascial union of the torn or separated levator ani muscles.



FIG. 220.—RUPTURE OF THE RECTOVAGINAL SEPTUM WITH EXTREME SEPARATION OF THE ENDS OF THE SPHINCTER, WHICH ARE INDICATED BY THE PITS OR DIMPLES AT EACH SIDE OF THE ANUS (Kelly).

Old Complete Rupture of the Rectovaginal Septum—Complete Laceration of the Perineum.—This is the third type of laceration in our classification. As in most cases the laceration is median, a triangular denudation with a row of sutures in the median line suffices to repair the injury. In the rare cases in which the laceration extends up one or both vaginal sulci with laceration of the deep pelvic fascia

and levator muscles, an operation of the Emmet type within the vagina is demanded in order to secure adequate support to the pelvic structures. In either case the operation upon the external or lower portion of the rectovaginal septum and the sphincter ani muscles is the same. In the rare cases in which the fetal head penetrates the rectovaginal septum and ruptures the rectum and sphincter ani muscle, leaving the introitus vaginæ intact, the operation is begun by clipping this commissure of tissue, which reduces it to one of the forms already discussed (Fig. 220).

The operation for complete rupture of the rectovaginal septum differs only from that described for the superficial tear (the median operation) and for the internal and external incomplete laceration (the Emmet operation) in the management of the laceration of the rectal wall and sphincter ani muscle. The variation in cases of complete rupture of the perineum which is of the greatest importance is as to the distance which the laceration extends up the anterior rectal wall. The external sphincter muscle may be torn with scarcely any laceration of the anterior wall of the rectum; or, on the other hand, the rupture may extend up the rectovaginal septum two or more centimeters, in which case not only the external sphincter ani, but also the internal sphincter is necessarily torn. The closure of the rupture of the anterior rectal wall introduces a factor in the operation which causes the operation to fail in perhaps 5 per cent. of the cases—infection of the perineal wound. As the rectum constantly contains pathogenic organisms, the infection of the wound in certain cases is easy to understand.

The point of chief importance, so far as securing continence of the rectum is concerned, is that the operator shall learn to recognize the location of the retracted ends of the torn sphincter ani muscle and to dissect out these muscle ends, so that they can be united directly, and thus secure end-to-end union with perfect restora-



FIG. 221.—PERINEORRHAPHY FOR COMPLETE LACERATION.

Kelly's method of exposing the retracted ends of the sphincter muscle by lateral incisions. The incisions over the ends of the sphincter can be avoided and the suturing simplified by passing a tenaculum from the surface of the wound, catching each sphincter end in turn, and delivering the sphincter end by splitting the tissues above it as it is delivered.

tion of the function of the sphincter. If this is not done and the sphincter ends are sutured together covered over with more or less loose tissue, at best only mediate union is obtained, and in a considerable percentage of cases the function of the sphincter is imperfectly restored with resulting partial incontinence of the bowel.

Operation.—The preparation for the operation is the same as for other operations upon the uterovaginal canal, with the exception that it is very important to secure absolute evacuation of the contents of the bowel. This is especially important when constipation has been present, as the passage of scybalous masses some days later through the recently united sphincter might well result in destroying the union secured. For this reason it is well to administer castor oil every other day for several days before the operation. For the same reason liquid diet should

be prescribed at least one day before the operation. The instruments necessary are the same as those used in the incomplete operation, and in addition two tenacula to catch up the torn ends of the sphincter.

The denudation is the same as for the incomplete operation so far as the vaginal wall and introitus vaginæ are concerned, so that this part of the operation will not be again described. The important point is to prepare the torn rectovaginal septum and sphincter ends for union. The denudation should begin at the pit which marks the retracted end of the sphincter to the left of the anus, and should follow the border of the rectal mucous membrane as far up as the laceration extends, then down the other side, ending at the pit over the retracted end of the sphincter to the right of the anus. The denudation of the skin perineum must follow in a general way the direc-



FIG. 222.—PERINEORRHAPHY FOR COMPLETE LACERATION.

The sutures to close the rent in the anterior wall of the rectum are shown already tied—closing the rent down to the border of the anus. The sphincter ani muscle is shown united directly by three fine catgut sutures. The reinforcing suture of silkworm-gut, embracing both ends of the torn sphincter muscle and the tissues of the rectovaginal septum, is introduced and ready to tie.

tion of the scar tissue, somewhat exaggerating its lines, and the lateral borders of the denudation of the skin perineum must unite the denudation at the border of the anus with that within the vagina, the junction of the two being just below the orifice of the vulvovaginal gland upon each side. This denudation upon the skin perineum may be outlined with a knife or may be made with an Emmet scissors under the guidance of the eye. It is important to extend the denudation within the vagina at least 1 cm. above the angle of the tear, whether the median operation or the Emmet operation be selected, in order to avoid the tendency to form a rectovaginal fistula at this point.

The suturing is best begun upon the rectal wall. Light weight interrupted catgut sutures (No. 1) are introduced to secure accurate approximation of the rectal wall. The needle should be introduced at the margin of the rectal mucosa,

emerging on the wound surface about 5 mm. distant, reentering on the opposite side and coming out on the margin of the mucosa at a point corresponding to that of entrance. Each suture should be tied as introduced, the knot being within the rectum. The sutures should be about 7 mm. apart. As the upper border of the sphincter ani is approached every other rectal suture should be of silkworm-gut. The catgut sutures may be cut short, but the silkworm-gut sutures should be left to project through the restored anus (Fig. 223). Usually two or three silkworm-gut sutures within the rectum are sufficient. When the anal border is reached, each sphincter end should be caught with a tenaculum and the connective tissue covering it dissected off with scissors until the sphincter ends can be made to emerge above the surface of the wound. The sphincter ends should be prepared for union by trimming away loose and scar tissue. The sphincter ends should be united by two light weight (No. 1) catgut sutures introduced from side to side and penetrating the entire thickness of the sphincter muscle upon each side. Before tying these sutures or before introducing them, as preferred by the operator, a silkworm-gut suture should be passed, entering the skin 5 mm. from the margin of the anal wound, passing through the sphincter muscle about 7 mm. from its torn end, passing through one side of the rectovaginal septum, and emerging into the wound; then reintroduced upon the opposite side, passing through the rectovaginal septum, the other end of the torn sphincter, and emerging through the skin at a point corresponding to its point of entrance. This suture when tied reinforces the catgut sutures and helps to keep the sphincter ends in apposition until sound healing is secured. Fig. 223 illustrates well the foregoing steps of the operation.



FIG. 223.—PERINEORRHAPHY FOR COMPLETE LACERATION.

The rectal sutures are introduced and tied. The reinforcing suture of silkworm-gut to support the sphincter ani until union takes place is introduced and ready to tie. The sphincter ends are shown drawn out for direct suture with fine catgut. This step is magnified in the drawing—they should not be drawn out more than 5 mm. beyond the surface of the wound.

The second silkworm-gut suture is introduced about 7 mm. in front of the

first, passes through the skin and tissues overlying the sphincter, passes through the sphincter itself in the direction of its fibers, and emerges upon the skin surface of the opposite side of the wound. These two silkworm-gut sutures give ample reinforcement to the buried catgut sutures.

When the tear extends up the rectal wall and involves the internal sphincter an attempt should be made in passing the next silkworm-gut suture to catch the retracted ends of the internal sphincter upon each side of the wound. Usually

one or two additional silkworm-gut sutures passed in the usual way suffice to approximate the remaining portion of the septum up to the plane of the hymen.

In practice the vaginal sutures are usually introduced and tied before those which approximate the skin perineum. Superficial sutures of light weight (No. 1 or No. 2) catgut should be used between the silkworm-gut sutures upon the skin perineum to secure accurate approximation. Care should be taken in tying the sutures, especially those through the sphincter ani muscle, to avoid tension, as especially in this operation tension from tight sutures interferes with the circulation and invites infection of the wound.

The ends of the silkworm-gut sutures projecting from the anus, those in the sphincter itself, and those upon the skin perineum, are cut at different lengths, so that they may be distinguished one from the others, and those within the vagina are treated as in the incomplete operation.

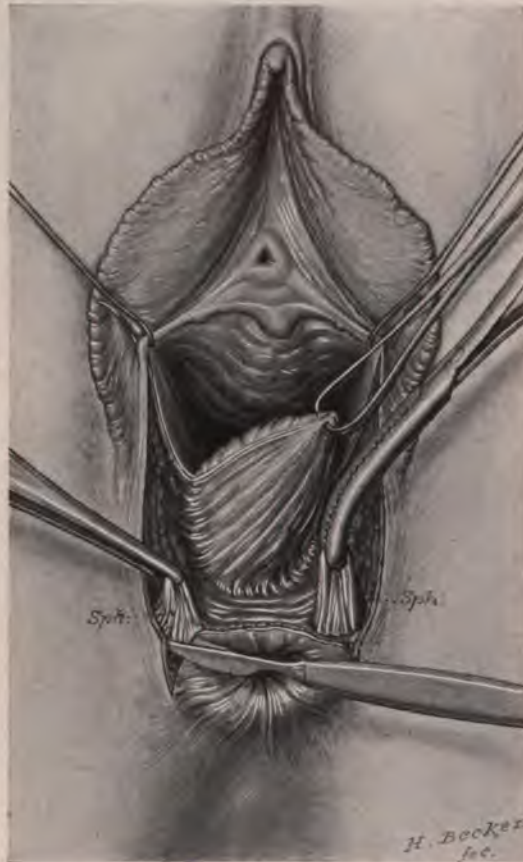


FIG. 224.—PERINEORRHAPHY FOR COMPLETE LACERATION. Kelly's method of delivering the sphincter ends for direct suture.

The operation is completed by douching out the vagina to remove clots, introducing a small pledget of gauze within the vagina, applying sterilized boric acid to the wound area, and dressing the wound with a sterilized perineal pad.

The operation, done according to the technic described, will give a perfect result in about 95 per cent. of cases. In probably every twentieth case infection of the perineum will occur, with failure of union of the sphincter. One of the least common results of infection is the formation of a rectovaginal fistula.

Flap-splitting Operations.—Because of the liability to infection of the perineal wound through the line of suture of the anterior wall of the rectum, various modifications of the operation have been devised with the object of overcoming the tendency to infection from the rectum. Lawson Tait¹ devised a flap-splitting operation, which has been developed by Snger and others, and which is now performed with his own modification by Edward J. Ill, of Newark. Tait made an incision with scissors in the form of the letter H. The transverse incision split the rectovaginal septum and the lower halves of the H extended to the retracted sphincter ends. The anterior ends of the H extended forward to the vulvovaginal junction. Flaps were turned forward and backward. The sutures were passed through the sphincter and through the perineum proper, and the vaginal and rectal flaps were left without suturing. As done by Tait, the operation was a crude one, although he claimed excellent results.

In the operation as performed by Ill, the flap turned toward the rectum is sutured along its borders, so as to restore the integrity of the rectal mucous membrane, by means of a continuous catgut suture. The vaginal flap is trimmed sufficiently to make it lie in neat apposition with the restored external perineum, and this flap is also sutured with a continuous catgut suture. All the remaining sutures are passed from the skin perineum, using a Baker Brown or Peaslee needle and silver wire as suture material. Ill reports (personal communication) almost perfect satisfaction with the operation as perfected by himself.

Howard A. Kelly has devised a flap-splitting operation the primary purpose of which is to avoid a wound communicating with the rectum.² This operation is combined with the principle of direct suture of the sphincter, a point worked out

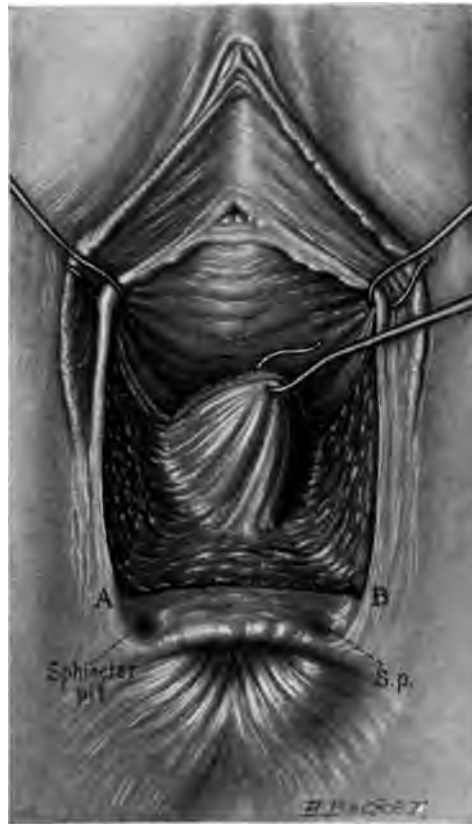


FIG. 225.—PERINEORRHAPHY FOR COMPLETE LACERATION.

An incision is made from A to B at least 1 cm. above the junction of the rectovaginal mucosa. The usual Emmet denudation is then made in the vaginal outlet and vaginal sulci.

¹ Tait, Lawson: "Diseases of Women and Abdominal Surgery," 1889, Phila., vol. i, p. 68.

² Kelly, H. A.: "The Operation for Complete Tear of the Perineum," Amer. Jour. Obst., 1899, vol. xl, No. 2.

by George E. Shoemaker,¹ Robert G. Le Conte,² and Kelly himself.³ The operation is performed as follows:

An incision is carried across the septum at least 1 cm.—more if the tear is a deep one—above the margin between the junction of the rectal and vaginal mucosa.



FIG. 226.—PERINEORRHAPHY FOR COMPLETE LACERATION.

Direct suture of the torn sphincter muscle by three fine catgut sutures.

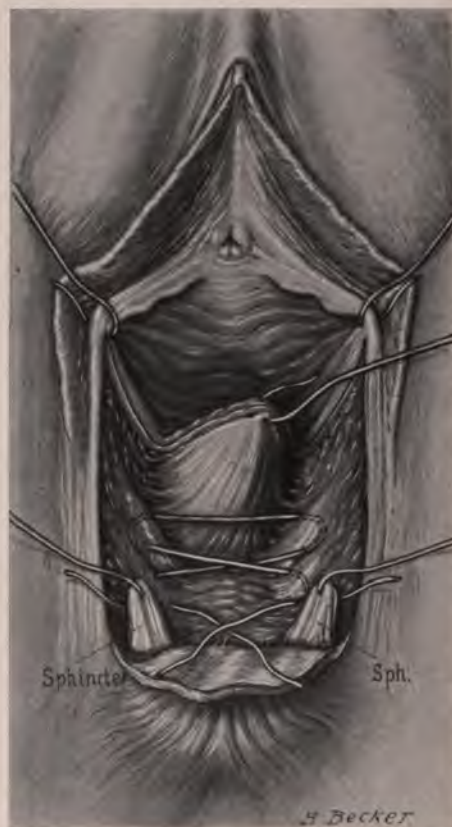


FIG. 227.—PERINEORRHAPHY FOR COMPLETE LACERATION.

1, A flap is turned down toward the rectum, which protects the perineal wound from infection from the bowel. 2, The sphincter ends are caught and liberated. This step is magnified in the drawing. 3, A figure-of-eight catgut suture is introduced to approximate the depths of the wound and the internal sphincter muscle.

This incision extends across the whole septum and above and beyond the sphincter ends (Fig. 225). Taking this as a base line, the operation on the vulvar and vaginal

¹ Shoemaker, George E.: "Celiotomy under Unusual Conditions," *Medical News*, 1894, vol. xlv, p. 329.

² Le Conte, Robert G.: "An Operation for the Restoration of the Sphincter Ani," *Amer. Jour. Obst.*, 1895, vol. xxxi, No. 6, p. 863.

³ Kelly, H. A.: "The Dissection and Liberation of the Sphincter Ani Muscle followed by its Direct Suture in Cases of the Complete Tear of the Perineum," etc., *Bulletin Johns Hopkins Hosp.*, 1899, vol. x, p. 1.

portion of the rent is then made in the usual manner as in the case of repair of an ordinary relaxed vaginal outlet. Having completed the denudation of these parts, with the bilaterally symmetric triangles in each side and the undenuded tongue of tissue on the posterior column, the operator then turns his attention to the complicating condition, the rectal side of the tear. He inserts his left index-finger into



FIG. 228.—PERINEORRHAPHY FOR COMPLETE LACERATION.

1, The sphincter ends are united directly by means of two or three catgut sutures. 2, A reinforcing suture of silkworm-gut is passed embracing both ends of the sphincter and the tissues of the septum, F, F. 3, One or more sutures of silkworm-gut are passed through the perineal surface, E, E. 4, The Emmet crown stitch is introduced, D, D. 5, The intravaginal sulcus stitches are introduced and tied.



FIG. 229.—PERINEORRHAPHY FOR COMPLETE LACERATION.

The suturing is completed. The apron or flap is drawn to one side by the sutures, and these are fixed to the buttock by adhesive plaster. The apron or flap may be trimmed with advantage before suturing it.

the bowel and draws the septum a little forward, and then carefully dissects the strip of undenuded tissue described above so as to free it and turn it down like an apron. A carefully conducted dissection will expose the internal sphincter muscle and avoid buttonholing the bowel (Fig. 227). At the sides of this flap the ends of the sphincter muscle are caught up and dissected free. The purpose of this flap

is to turn down an apron or fold of tissue which, when the sutures are all in place, projects out of the anal orifice and points in a direction away from the impact of the fecal masses. By making this apron, the operator is able to avoid the presence of a wound on the rectal surface and thus avoid the risk of infection from the rectum. When the denudation is complete and the apron turned down, the operator will then be able to avoid the second complication, the presence of a dead space in the center of the septum, by the following plan of suturing: About three or four catgut sutures are applied in the form of the figure-of-eight, beginning above and introducing each suture so as to grasp the fibers of the internal sphincter muscle well to one side of the median line sutures, then carried to the opposite side, then passed through the tissues in the septum well above the internal sphincter; it then returns to the first side and includes the corresponding area of tissue, and is finally brought out through the internal sphincter at a point corresponding to the point

of entrance (Fig. 227). This entire suture is buried in the septum and no part of it appears on any part of the surface. By the use of three or four sutures of this kind broad plane surfaces are brought together in the middle of the septum and the space is obliterated in which accumulations are so apt to form. The use of this figure-of-eight suture in this way takes the place of a much larger number of interrupted sutures, and, moreover, instead of securing a thin line of union with weak spaces between, approximates planes.

After uniting the center in this way as the first important step in the suturing, the next step is to pass the sutures on the vaginal surface, approximating the triangles there. The next sutures are applied on the perineal surface, and here two or three common silkworm-

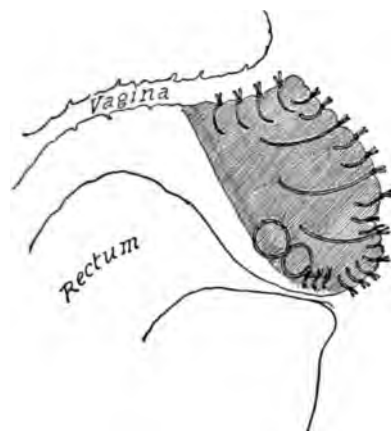


FIG. 230.—PERINEORRHAPHY FOR COMPLETE LACERATION.

Sagittal section showing the relation of the sutures in Kelly's flap operation.

gut sutures are used in addition to the catgut sutures between them (Fig. 228).

Before uniting the center of the perineum with figure-of-eight sutures the sphincter ends are laid bare and united directly by means of three light weight catgut sutures, and these sutures are reinforced by one or more sutures of silkworm-gut passed from the skin surface and embracing both ends of the torn sphincter ani muscle (Fig. 226).

The final step in the operation is the union of the edges of the apron, which lie now more or less crumpled together and projecting at the anus; by leaving these sutures long and making slight traction, this entire line can be drawn well outside and fixed on the buttocks by a strip of adhesive plaster (Fig. 229).

The relation of the sutures to the structures of the perineum is well shown in Fig. 230.

As a result of experience with the operation at the Johns Hopkins Hospital clinic the apron of tissue is now trimmed before it is sutured, greatly reducing its size. This avoids an accident which happened in a certain percentage of cases, namely, the sloughing of the apron from devitalization of its tissues. Kelly claims practically perfect results from this method.

George H. Noble, of Atlanta, has devised an operation whose purpose is the same as that described, namely, to avoid infection of the perineal wound from its rectal side.¹ Instead of turning down a flap he dissects the border of the rectal wall loose from its anterior connections and frees it sufficiently to draw the rectal wall down to the level of the anus, after which the operation proceeds as has been described in the typical operation. By this procedure the line of sutures and the open wound within the rectum are avoided.

Repair of the Ruptured Sphincter Ani with an Intact Perineum.—In rare instances the sphincter ani muscle is torn without any external laceration of the skin or vaginal mucous membrane. Usually in such cases there is also a laceration of the levator ani muscles with a resulting relaxed vaginal outlet. More often the condition is present as the result of an unsuccessful operation for the cure of a complete rupture of the perineum. Union of the perineum proper is obtained with the failure to restore the sphincter ani muscle. In such cases one of two methods must be adopted when the laceration of the sphincter itself is the only lesion to be dealt with.

An anteroposterior incision is made through the skin perineum to, but not through, the anterior wall of the rectum. A tenaculum is now inserted into the tissues upon each side and made to catch the retracted end of the sphincter muscle. The tissues over the sphincter ends are either split or cut away so as to permit the delivery of the sphincter ends above the surface of the wound upon each side. The sphincter ends are now brought together with two interrupted catgut sutures, and interrupted silkworm-gut sutures are passed as has been described in the typical operation. This method has proved quite satisfactory in my hands.

For such cases Kelly has made a curved incision through the skin anterior and parallel to the border of the anus down to the retracted ends of the sphincter (Fig. 231). The dissection is made deep enough to lay open the tissue between the retracted ends. Each end of the sphincter is then dissected free and united with interrupted catgut sutures (Fig. 232). The method of completing the operation is indicated in Fig. 233. At least one silkworm-gut suture should be used to splint the sphincter ends and reinforce the catgut sutures.

After-treatment of Complete Rupture of the Perineum.—The after-treatment of plastic operations in general has been treated on pages 350–358, but the method of managing the bowels after operation for the repair of the lacerated sphincter ani muscle will be considered here. Two methods have been employed. The

¹ Noble, George H.: "A New Method of Suturing the Fascia and Levator Ani Muscle," etc.; also "An Operation for Complete Laceration of the Perineum," etc.; *Trans. Southern Surg. and Gynec. Soc.*, 1902, vol. iv, p. 92.

original method was to administer opium and to keep the bowels constipated for from one to three weeks until sound healing of the sphincter was obtained, then to administer purgatives, removing scybalous masses from the rectum manually, if necessary. The other method was to administer purgatives daily or on alternate days, beginning usually three days after the operation. The first method has fallen into disuse as formerly practised, but of late years it has been used in a modified way.¹ Only such diet as leaves little or no residue in the bowel is administered—albumin water, strained broth, tea, coffee, and fruit juices. At the end of one or two weeks laxatives are given in the usual way. The method has distinct advantages, but in some cases leads to autointoxication from intestinal putrefaction. In 1898 I tried this method



FIG. 231.—LACERATION OF THE SPHINCTER ANI MUSCLE WITH INTACT PERINEUM.

An incision is made along the dotted line parallel with the anal border, from one retracted sphincter end to the other.



FIG. 232.—LACERATION OF THE SPHINCTER ANI MUSCLE WITH INTACT PERINEUM.

The sphincter ends are exposed for direct suture with buried catgut. The exposure of the sphincter end is magnified in the drawing—these should not be drawn out more than 5 mm.



FIG. 233.—LACERATION OF THE SPHINCTER ANI MUSCLE WITH INTACT PERINEUM.

The skin incision is sutured. At least one reinforcing suture of silkworm-gut should be introduced to support the sphincter ends in position until union takes place.

with success in some cases; in one, violent and almost fatal autointoxication resulted. The usual method is to administer laxatives, such as compound licorice powder, castor oil, or salts, on the third day and on alternate days thereafter. The action of the purgative is assisted by giving oil or simple enemas.

The method which I have followed is to administer an ounce of castor oil in the morning and follow it with an enema of four ounces of sterilized sweet oil. When the patient experiences a desire for evacuation, a simple enema is administered through a soft catheter. The patient lies upon her side when the bowels move and is instructed not to strain. The process is repeated every other day

¹ Kelly, H. A.: "Starvation and Locking the Bowels for from Ten Days to Two Weeks," *Surg., Gynec. and Obstet.*, 1906, vol. ii, No. 2, p. 179.

until the operation is ten days or two weeks old, after which daily evacuations are secured with sulphur or compound licorice powder and the enemas are suspended. Of late the restricted diet given above has been administered for a week, when the bowels have been opened after the plan just detailed.

The nursing of complete perineal lacerations should be intrusted only to an experienced nurse, as an inexperienced or careless nurse can easily spoil such an operation.

Possibility of Laceration of the Perineum in Subsequent Labor.—The question of the probability of rupture of the perineum in subsequent labor is one frequently asked by patients and one which must enter into a proper estimate of the value of any operation for the restoration of the perineum. I am not aware of any extensive statistical studies of this subject. If the pelvic floor is restored approximately to the normal condition, the prospect of rupture in subsequent labors should be about that of primiparæ, which is estimated at 20 per cent., probably a low estimate.

PROLAPSE OF THE UTERUS—HERNIA OF THE PELVIC CONTENTS.

Prolapse of the uterus, or falling of the womb, are terms which have been applied to varying conditions. The more extreme forms of prolapse, involving the bladder, vagina, and uterus, constitute a hernia of the pelvic contents. The term "falling of the womb" is sanctioned by long usage, but with the exception of the lesser grades of the displacement it is really a misnomer, as other organs are necessarily involved in the displacement.

Normal Supports of the Pelvic Contents.—From the standpoint of support of the pelvic contents and from the functions of the parts in labor, the floor of the pelvis is divided into an anterior (or pubic) and a posterior (or sacral) segment. The anterior or pubic segment is made up of the anterior wall of the vagina, the vesicovaginal septum, the uterus, and the uterosacral ligaments. These structures are so arranged that they can be drawn upward in the pelvis during labor to permit of the descent of the fetal head. In themselves they have little power of resisting intra-abdominal pressure, which would and does drive these structures downward unless supported from below. The attachments of the uterosacral ligaments to the sacrum and of the vesicovaginal septum to the pubes are sufficiently strong to afford a limited support to the uterus and bladder.

The posterior or sacral segment of the pelvic floor is so constituted as to give support to the superimposed pelvic structures and to resist the force of intra-abdominal pressure—a force which is constantly acting except when the individual is at rest. The construction of the sacral segment of the pelvic floor is such that it can be driven down in labor and thus permit of the dilatation of the outlet of the pelvis and the delivery of the fetal head.

The chief structures contained in the pelvic floor which give support to the pelvic contents are the levator ani muscles and the deep pelvic fascia or triangular

ligament, with its prolongation, the vesicorectal fascia. The transversus perinei muscles probably have a limited function in the same direction. The pelvic fascias are so arranged as to give the constant support needed to the pelvic contents under ordinary conditions. Under the extreme conditions of lifting, straining, etc., in which the use of the abdominal muscle increases intra-abdominal pressure, the levator ani muscles are brought into use to counteract or oppose the effect of the contraction of the abdominal muscles, supporting the lower end of the rectum and vagina and keeping the vagina closed during such muscular efforts. The direction of the vaginal canal is such that intra-abdominal pressure normally falls upon it at a right angle. Another and very important factor is that the uterus, except when the bladder is full, is normally anteflexed and rests upon the empty or partly empty bladder and vesicovaginal septum; thus the force of intra-abdominal pressure falls upon its posterior wall, and under the influence of muscular exertion merely tends to increase the anteflexion of the uterus by driving the fundus down upon the bladder and vagina. On the other hand, when the bladder is full, or when the uterus is retroverted, the force of intra-abdominal pressure falls upon the fundus itself and tends to drive the uterus down the vaginal canal and to invert that organ.

Etiology.—It follows from the physical facts contained in the section on the normal supports of the pelvic contents that whatever will increase the force of intra-abdominal pressure or the weight of the uterus or other contents of the pelvis, on the one hand, and whatever will cause relaxation of the proper ligaments of the uterus and whatever will destroy the supporting function of the sacral segment of the pelvic floor or perineum, on the other hand, will favor and may lead to the development of prolapse of the uterus, or to hernia of the pelvic contents. For practical purposes cases must be divided into those which are caused by (1) excessive intra-abdominal pressure; (2) increased weight of the uterus or other pelvic contents, such as tumors, (3) relaxation of the normal ligamentary supports of the uterus; and (4) injuries of the perineum or sacral segment of the pelvic floor. As a matter of fact, almost all the cases are caused by the last factor, but in order that the consideration of the question may be complete, each cause must be considered in detail.

Intra-abdominal pressure is constantly exerting its force upon the contents of the pelvis except when the body is at rest. Normally it is a conservative force. Even under extreme pressure induced by excessive muscular effort, the force exerted upon the pelvic viscera in a downward direction is met and counteracted by the contraction of the levator ani muscles, and no harm results. When the bladder is full or when the uterus is retroverted, at times the uterus is forced down even though the pelvic floor is intact. This accident is so rare that not more than two or three instances of it have come under my observation. In these women, who were of poor physical development, prolapse of the uterus occurred as a result of long-continued heavy work involving lifting. Cases are reported in the literature in which prolapse of the uterus occurred in little girls as a result of overwork, such as constant lifting

of their younger brothers or sisters. Cases are also reported of prolapse from traumatism, such as falls from a height; but no case of either class has come under my observation.

Increased weight of the uterus or other pelvic contents favors the production of procidentia. I have seen a few cases in which the uterus was prolapsed when the condition was evidently due to the weight of a fibroid tumor. Occasionally other tumors in their growth push the uterus down. Such cases are rare and are of practical interest only in connection with the operation for the removal of the tumors, at which time whatever is necessary to correct the displacement of the uterus should be done.

Increased weight of the uterus caused by subinvolution after labor is a much more frequent factor. The subinvolution of the uterus is usually associated with subinvolution and relaxation of the proper ligaments of the uterus and of the vagina and usually also with injuries of the perineum. In the absence of retroversion and of injury of the perineum, subinvolution of the uterus may cause descensus of that organ, but not a greater degree of prolapse. If retroversion occurs and treatment is not instituted, under the action of intra-abdominal pressure in a woman leading a laborious life, prolapse may be produced even with an intact perineum, but such a result is most unusual.

Relaxation of the normal supports of the uterus plays a small rôle in the production of procidentia. This applies more especially to overstretching of the uterosacral ligaments and broad ligaments as a result of the action of intra-abdominal pressure. Both the uterosacral and broad ligaments contain muscular fibers which may not undergo perfect involution after labor, and it is at this time that they are most easily overstretching. This question is considered more fully in connection with retroversion in the chapter on Shortening the Round and Uterosacral Ligaments.

Injuries of the perineum involving the laceration of the muscles of the sacral segment of the pelvic floor and of the pelvic fascias are the usual cause of procidentia uteri and hernia of the pelvic contents. When the fascias are torn, the constant resistance is lost which they normally offer to the downward displacement of the pelvic contents brought about by the action of intra-abdominal pressure; and when the levator ani muscles of the perineum are torn to any extent, their action is lost in resisting the strain from violent muscular exertion. The outlet of the pelvis is no longer closed; the perineum and rectum drop downward and backward; the vaginal canal is no longer at a right angle to the direction of the intra-abdominal pressure, and as a result the vaginal walls roll out under straining efforts, and eventually the vagina, bladder, uterus, and pelvic contents become prolapsed. Complete rupture of the rectovaginal septum is seldom associated with procidentia uteri, because extensive injury of the pelvic fascias and levator ani muscle seldom constitutes a part of this form of laceration.

Congenital defects of the vaginal outlet and pelvic floor may supply the factors necessary for the formation of the prolapse. Such a case has not come under

my observation. Deformities of the vertebral column changing the angle at which intra-abdominal pressure meets the resistance of the pelvic floor may favor prolapse.

PROLAPSE OF THE UTERUS AND OTHER PELVIC ORGANS.

Descensus Uteri.—When the uterus sags in the pelvis so that it occupies a lower plane than normal, it is usually classified as descensus uteri or the first stage of prolapse. When the uterus is retroverted or retroflexed, as a rule it occupies



FIG. 234.—INCOMPLETE PROLAPSE OF THE UTERUS.

The uterus is enlarged and retroverted. The vagina is partly inverted. The perineum is torn, with resulting rectocele.

a lower plane than normal. These displacements of the uterus have no essential relation to laceration of the perineum and frequently exist in nulliparæ and virgins. Descensus uteri is caused by relaxation of the normal ligamentary supports of the uterus or by increase of intra-abdominal pressure or both. Poor general health and the lack of muscular development affecting the functional integrity of the ligamentary supports of the uterus are causative factors. Retrodisplacement of the uterus may

be due to the same causes; it may be congenital; it may be due to subinvolution; or it may be due to the action of intra-abdominal pressure with a full bladder and rectum pushing the fundus backward and the cervix forward.

Incomplete Prolapse.—When the prolapsed uterus has not escaped from the vagina, the degree of the displacement is classified as incomplete. In such cases the vagina is necessarily partially inverted, and cystocele and rectocele may or may not exist, depending usually upon the extent of the laceration of the perineum (Fig. 234).



FIG. 235.—COMPLETE PROLAPSE OF THE UTERUS AND VAGINA.

Hernia of the pelvic contents. The vagina is completely inverted. The perineum is torn. Cystocele and rectocele exist. Posterior enterocele can readily occur.

Complete Prolapse.—When the uterus has escaped entirely or almost entirely from the vagina, the displacement is classified as complete. In such cases necessarily the vagina is everted completely, or almost completely, and is detached from its normal connections laterally, posteriorly, and more or less anteriorly. In such cases the uterosacral and broad ligaments necessarily are greatly overstretched. Because of the contact of the air with the mucous membrane of the vagina, it

becomes dry and resembles the external skin in its appearance. Friction not infrequently causes ulcers to form upon the cervix or other portions of the prolapsed mass. Complete prolapse of the uterus and vagina is more correctly described as a hernia of the pelvic contents (Fig. 235).

Cystocele.—Cystocele, or hernia of the bladder, usually is associated with prolapse of the uterus. The bladder may, though rarely, prolapse with the uterus *in situ*, which is most apt to occur in women past the menopause. After the menopause the senile involution of the uterus and the atrophy and absorption of the fat about the vagina and nates are two conditions not present in younger women and which influence the type of the prolapse. The bladder may prolapse first and the uterus follow it, or the reverse, depending upon the preponderant influence of the laceration of the perineum or undue intra-abdominal pressure. The portion of the bladder in immediate relation with the anterior vaginal wall, or a much greater portion, may be involved in the prolapse. Urination, and especially complete emptying of the bladder, is mechanically difficult in cases of cystocele, with the result that residual urine is contained in the bladder, which frequently undergoes decomposition and causes cystitis. In extreme cases of cystocele and prolapse of the uterus the ureters may be overstretched or otherwise obstructed, which may lead to pyelonephritis.

Rectocele.—Rectocele or prolapse of the posterior vaginal and anterior rectal walls is due to laceration of the perineum involving the triangular ligament, rectovesical fascia, and anterior portion of the levator ani muscle whereby the support afforded the posterior vaginal and anterior rectal walls is lessened or destroyed. Under these conditions the rectum is imperfectly supported, the lower rectum drops downward and backward, the direction of the vaginal canal is altered, so that the direction of intra-abdominal pressure falls upon the sacral segment of the pelvic floor at an obtuse angle instead of a right angle; the vaginal orifice is no longer closed, but lax and gaping; hence, under the influence of lifting or straining efforts the posterior vaginal and anterior rectal walls are caused to roll downward and forward through the vulva. Frequently the attachments of the posterior vaginal and anterior rectal walls become overstretched and loosened, and a false bursa forms between the two.

Hypertrophic Elongation and Overstretching of the Cervix.—The infra-vaginal cervix at times, though rarely, is hypertrophied; more frequently the supra-vaginal cervix is greatly overstretched, so that the length of the uterine canal may be even twice the normal. Overstretching of the cervix is most apt to occur when marked injury of the pelvic floor with normal ligaments of the uterus exist in the same patient.

Enterocoele.—Enterocoele may exist as a complication of procidentia uteri. The intestines usually come down behind the uterus and lie behind the prolapsed posterior vaginal wall. Rarely they come down in front of the uterus, displacing the bladder from its connection with that organ, in which case they lie behind the anterior vaginal wall.

TREATMENT.

The curative treatment of prolapse of the uterus is almost necessarily operative in nature; cases of descensus uteri and simple retroversion form an exceptional class. Descensus uteri may be cured by hygienic and tonic treatment. Vaginal tampons or a pessary may at times be indicated. The treatment of retroposition of the uterus is considered elsewhere. The remaining cases from the standpoint of treatment must be divided into two classes: (1) Those in which with an intact perineum increased intra-abdominal pressure has forced the uterus down; or those in which the weight of a tumor has forced it down; (2) those in which injury of the perineum, with loss of support from the sacral segment of the pelvic floor, has permitted the contents of the pelvis to be driven down by intra-abdominal pressure.

Operation upon the first class of cases necessarily has to deal with the ligamentary supports of the uterus. The pelvic floor is normal and requires no treatment. If the vagina is inverted and more or less detached, lateral or posterior colporrhaphy, or both, in the upper portion of the vagina may be indicated. The operations employed to restore the normal ligamentary support of the uterus, or as a substitute for the support, are shortening the round ligaments, shortening the uterosacral ligaments, suspensio uteri, and hysteropexy, and the reader is referred to the chapters dealing with these operations.

When the uterus is driven down by the weight of tumors, the curative treatment involves the removal of the tumor. If the tumor is ovarian, after its removal it will suffice to shorten the uterosacral ligaments or the round ligaments or to perform suspension of the uterus, as may be indicated in the particular case. If the tumor is a fibroid of the uterus and supravaginal hysterectomy is called for, the round ligaments and upper borders of the broad ligaments should be stitched behind the cervix to give support to that structure; or the cervix itself should be stitched to the abdominal wall.¹ In case myomectomy is indicated for a fibroid tumor, it may be wise to disregard the prolapse of the uterus, as firm adhesions of the uterus to the abdominal wall may form under these conditions, if either suspensio uteri or shortening of the round ligaments is performed. Cases are on record of dystocia in labor due to this fact.

Operation upon the second class of cases is necessarily much more extensive, because additional indications must be fulfilled. The perineum or sacral segment of the pelvic floor is restored to the normal, the vagina is reattached laterally or posteriorly, the anterior vaginal wall is resected to restore this structure to the normal and cure the cystocele, the cervix is amputated to lessen the size and weight of the uterus and to promote involution of the organ, and the same intra-abdominal operations upon the ligaments of the uterus (or upon the uterus itself) are indicated as in class one.

It is my practice to perform the following series of operations in a typical case

¹ Noble, Charles P.: "A New Operation for Certain Cases of Procidentia Uteri," *Amer. Gynec. and Obstet. Jour.*, May, 1896.

of marked prolapsus uteri et vaginæ: (1) Curetage of the uterus; (2) amputation of the cervix; (3) anterior colporrhaphy (resection of the anterior vaginal wall) combined with detachment of the bladder from the anterior surface of the cervix and suture of the vagina to the cervix as high as the internal os to elevate the bladder; (4) perineorrhaphy; (5) suspensio uteri. In young women when the prolapse is partial, shortening of the round ligaments may be substituted for suspensio uteri. In cases of complete prolapsus uteri et vaginæ, with marked overstretching of the uterosacral ligaments and detachment of the vagina posteriorly and laterally, it is best to supplement the suspension of the uterus with shortening of the uterosacral ligaments. The reader is referred to the various chapters treating of these operations for the details of their performance.

Owing to the repugnance of certain women to submit to local or operative treatment and to the neglect of the profession to recommend operative treatment when indicated, prolapsus uteri is a not uncommon trouble in elderly women. Many women have suffered from this annoying condition for from twenty to forty years before they come under observation. In elderly feeble women the question will naturally arise as to what palliative treatment may be employed to improve if not to cure the condition. Because of the complicated nature of the trouble, and more especially because of the injury of the perineum, any treatment other than the ideal can have but indifferent results. Occasionally a round hard-rubber or soft-rubber ring pessary will be retained in the vagina, and will afford a certain amount of support to the prolapsed bladder and uterus and give considerable relief. The various cup-and-stem pessaries attached to abdominal belts, which are sometimes used, usually give more discomfort than the condition for which they are employed.

OPERATIONS FOR THE REPOSITION OF INVERSION OF THE UTERUS.

By inversion of the uterus is meant the partial or complete turning of the organ inside out. As a rule, the cervix is not involved and remains as a collar around the isthmus of the inverted corpus. This displacement of the uterus is very rare.

Inversion of the uterus occurs in labor during or after the third stage. It has been caused by unskilled attempts at the manual removal of the placenta and by efforts at delivering the placenta by traction upon the cord. It may occur spontaneously after labor. In non-puerperal cases it is due to the efforts of the uterus to expel a fibroid tumor attached to its walls, especially to the fundus. Under these conditions inversion is caused by the expulsive efforts of the uterus relaxing the lower portion of the uterus, by which the tumor is finally forced into the vagina, dragging with it the attached portion of the uterine wall. When the inversion is marked, and especially when it is complete, the peritoneal surface of the uterus is contained within the inverted organ along with the Fallopian tubes. Kelly reports one case of inversion due to a sarcoma.

Symptoms.—When inversion occurs after labor, it may or may not be accompanied with symptoms of shock and hemorrhage. The most characteristic

symptom in both puerperal and non-puerperal cases, if the inversion remains unreduced, is hemorrhage. The hemorrhage is usually sufficient to cause marked anemia. Leukorrhea, backache, and pelvic tenesmus are common symptoms.

Diagnosis.—The diagnosis must be made by bimanual examination and is best conducted under the influence of general anesthesia. The diagnosis is easy if a red, bleeding, pyriform tumor about 3 cm. in diameter, larger below and con-



FIG. 236.—INVERSION OF THE UTERUS.
The vaginal portion of the cervix is not inverted.

tracted above, is found filling the vagina, and if upon bimanual palpation a depression is felt entering the tumor on its peritoneal surface, and an absence of the corpus uteri in its usual relations can be definitely made out, and if the cervix can be felt surrounding the isthmus of the uterus as a collar. If the inversion is complete, the cervix itself is inverted and cannot be distinguished at the vaginal vault. If the inversion is incomplete, the fundus may be felt through the dilated cervix

or may project through it into the vagina. In such a case the differential diagnosis from an intrauterine polyp in process of extrusion must be made by bimanual palpation. In the case of a fibroid polyp the enlarged uterus will be felt in its usual relations to the cervix, whereas in the case of a partial inversion of the uterus the shortened uterine body can be recognized and a depression can be made out entering the tumor on its peritoneal surface. Sometimes useful information can be elicited by the use of the uterine sound. Partial inversion of the uterus, caused by the partial extrusion of a fibroid tumor through the cervix, is a condition offering decided difficulties in differential diagnosis. For this reason, whenever a fibroid tumor is enucleated from within the uterus, the possibility of partial inversion should be borne in mind so as to lessen the liability of perforating the uterine wall in the removal of the tumor.

Prognosis.—The prognosis of inversion of the uterus when left to nature is unfavorable. Instances of spontaneous reposition are on record, but are very rare. Without treatment death from hemorrhage or sepsis is to be anticipated.

The Reduction of Inversion by Taxis.—This method is especially adapted to cases of recent inversion of puerperal origin. If resorted to without delay, it should always be successful. The longer the inversion has remained unreduced, the less the prospect of success. In chronic cases excessive efforts and injudicious persistence must be avoided, as perforation and sloughing of the uterus have followed such efforts with fatal results.

Hirst¹ enumerates the following plans of applying taxis: (1) Inserting the whole hand into the vagina, surrounding the isthmus uteri within the cervix with the fingers and thumb, making pressure upon the fundus with the palm of the hand, and counter-pressure upon the cervical ring above the abdominal walls (Emmet); (2) placing the thumb and middle finger against the uterine horns, making pressure first upon one and then upon the other, and, after reinverting the horns, replacing the fundus, counter-pressure being made upon the cervix from above (Noeggerath); (3) making pressure with the finger-tips of one hand against the lateral wall of the lower uterine segment in a direction forward and upward, while an assistant with both hands presses upon the cervical ring from above and endeavors to dilate it by traction in opposed directions through the abdominal walls (Hirst has reduced five cases of inversion in this manner); (4) inserting two fingers into the rectum and making traction upon the cervical ring, while pressure is applied with the other hand to the fundus (Courty); (5) inserting two fingers in the rectum, the forefinger of the other hand in the bladder through a dilated urethra, making traction upon the cervical ring, while the two thumbs press upon the uterine fundus (Tate, of Cincinnati).

The Reduction of Inversion by Long-continued Pressure.—Many methods have been devised by which continuous pressure was to be made against the inverted uterus in order to bring about its reposition. White, Byrne, and Aveling have invented instruments with a cap at the inner end to press against the fundus,

¹ Hirst, Barton Cooke: "Text-Book of Diseases of Women," Phila., 1903.

the pressure to be applied through curved or S-shaped rods to the ends of which rubber bands are fastened connected to an abdominal belt. Success has been achieved with such appliances, but it is always problematic. In two cases which came under my observation the method proved a failure. Pressure has been applied also by means of tampons and rubber bags, which method has seldom been successful.

Operation for Inversion of the Uterus.—Thomas devised the first method for the reduction of inversion by means of a cutting operation.¹ He proposed as a substitute for amputation, after the failure of taxis and long-continued pressure, that the abdomen be opened, the cervical ring dilated from above with a steel instrument made like a glove-stretcher, and that then reposition of the inverted uterus be made by taxis. He reports one successful and one fatal case operated upon by this method. The various historic methods of treating inversion, most of which have been superseded by taxis and direct incision, are treated of at length in Thomas' "Diseases of Women."

Other methods of operation are discission of the cervix; median complete division of the cervix and uterine wall toward the fundus either anterior or posterior, with colpotomy to permit the repair of the uterine wound after reposition; vaginal hysterectomy.

Splitting the cervix is the simplest of the operative procedures and should be employed first. Barnes and Sims, among others, recommended superficial incisions of the cervix as an aid to taxis. It is questionable whether such superficial incisions would be of any service. Hirst has recommended the complete division of the cervix.² The cervix was split in the median line posteriorly, the incision being carried higher on the internal than on the external surface, the ring muscle thus being almost if not completely severed without opening the peritoneal cavity. With comparatively light pressure, with one finger-tip on the lower uterine segment just above the upper angle of the wound, he easily reinverted the uterus. The cervix was then united by sutures. The operation was easy and the patient made an afebrile recovery. Whenever this operation will answer, it should be preferred to all others, as it is practically free from risk.

When reinversion cannot be accomplished after discission of the cervix, a free incision may be made into Douglas' pouch, the peritoneal cavity packed off with gauze, and the posterior median incision of the cervix may be continued upward toward the fundus far enough to permit reinversion of the uterus. The incision in the corpus should then be sutured through the posterior colpotomy wound with catgut sutures, and the incision through the cervix with either catgut or silkworm-gut sutures. In all such cases it will probably be best to drain Douglas' pouch with gauze.

According to Oui,³ whose monograph gives all the recent literature on the subject, this method is original with Piccoli and was proposed in 1894.

¹ Thomas, T. Gaillard: "Diseases of Women," New York, 1880, p. 469.

² Hirst, Barton Cooke: "A New Operation for Persistent Inversion of the Uterus," *Amer. Jour. Obstet.*, 1900, vol. xli, pp. 9, 205.

³ Oui: "Traitement de l'Inversion Utérine," *Ann. de Gynéc.*, 1901, Tome lvi, p. 377.

Küstner¹ devised the following method: (1) A wide transverse incision into Douglas' cul-de-sac; (2) the introduction of the index-finger through this opening into the inversion funnel of the uterus and separation of any adhesions found; (3) a longitudinal incision through the posterior uterine wall in the median line, beginning about 2 cm. below the inverted fundus and ending about 2 cm. above the os externum; (4) reinversion of the uterus by fixing the funnel with the index-finger in Douglas' pouch, and pressing in the fundus with the thumb of the same hand; (5) suture of the uterine incision by deep and superficial sutures passed on the peritoneal surface; (6) closure of Douglas' cul-de-sac with sutures. This operation when proposed was an advance on any in use, but upon theoretic grounds, at least, seems much inferior to discission of the cervix followed, if necessary, by incision of the corpus from below upward, together with posterior colpotomy.

Anterior incision of the cervix and uterus may be employed instead of the posterior incision. According to Ovi (*loc. cit.*) the anterior operation was first performed by Kehrer and Spinelli. The incision, may extend to the uterovesical reflection of peritoneum or the peritoneal cavity may be opened for intraperitoneal manipulations. The operation does not differ essentially from that described on the posterior wall. Because of the difficulty of draining the peritoneal cavity through an anterior colpotomy incision, and because of the risks of infecting the peritoneum in operations upon a suspicious or a septic field, such as is afforded by inversion of the uterus, it would seem preferable to select the posterior operation for cases of inversion of long standing in which it will probably be necessary to open the peritoneal cavity.

Anterior hysterotomy has been performed with success, among others by Peterson.²

In the past, after the failure of attempts at reposition of the uterus, one of two operations has been performed to rescue the patient from the dangers of hemorrhage and sepsis—amputation of the inverted uterus or vaginal hysterectomy. With the present methods of operation at his disposal, the surgeon should only resort to a mutilating operation in the presence of extensive sloughing or other complications distinctly extraordinary.

¹ Küstner, Otto: "Methode konservirender Behandlung der inveterirten Inversio uteri puerperalis," *Centralb. f. Gynäk.*, 1893, vol. xvii, No. 41, p. 945.

² Peterson, Reuben: "Case of Inversion of the Uterus of Sixteen Months' Standing; Replacement by Anterior Colpotomy and Anterior Uterotomy, with Recovery."

CHAPTER VII.

COMBINED GYNECOLOGIC OPERATIONS.

BY GEORGE M. EDEBOHLS, M.D.

Definition.—Under the heading of Combined Gynecologic Operations it is proposed to consider briefly, and in an outline and suggestive way merely, the subject of the performance at one and the same sitting of two or more operations usually classed as gynecologic. While this definition, strictly speaking, would indicate the limits of this chapter as imposed by the title, yet we find in the everyday practice of gynecic surgery that the interests of our patients frequently and imperatively demand the performance of additional operations not essentially gynecologic in character, or at least not usually so considered. Consideration of the latter class of operations, especially those involving the viscera and walls of the abdomen, the rectum, the urethra and bladder, cannot be dodged when gynecologic operations as a whole are under discussion.

For practical purposes the operations which the modern gynecologic surgeon is most likely to be called upon to perform in combination at the same sitting may be classed and considered under three general headings:

I. The various operations, for the greater part plastic in character, upon different parts of the genital and lower urinary tracts and rectum, *not involving the opening of the peritoneal cavity.*

II. These same plastic operations combined with operations upon the uterus, its adnexa and the vermiform appendix, involving either abdominal or vaginal section or both.

III. Operations embraced under both I and II with the addition of shortening of round ligaments, nephropexy and herniotomy.

I. Combined Plastic Operations Performed at One and the Same Sitting.—Twenty-five years ago the performance of more than one plastic operation upon a patient at the same sitting must have been a great rarity. Baumgaertner,¹ in 1876, recorded a case of excision of the cervix, anterior colporrhaphy and colpo-perineorrhaphy performed at one sitting, and Bockelmann,² in 1884, described a combined operation for complete prolapsus, performed by Fritsch, made up of anterior colporrhaphy, excision of the anterior lip of cervix, reunion of the torn sphincter ani, and posterior colporrhaphy. Lossen,³ in 1879, and Martin,⁴

¹ Baumgaertner, J.: "Prolapsus uteri," etc., Berl. klin. Wochenschr., 1876, xiii, 112, 130.

² Bockelmann, W.: "Operation eines Scheiden und Mastdarmvorfalles," etc., Centralbl. f. Gynak., Leipzig, 1884, viii, 161-167.

³ Lossen, H.: "Zur operativen Behandlung des Prolapsus der Vagina," etc., Berl. klin. Wochenschr., 1879, xvi, 597-600.

⁴ Martin, A.: "Juniper Catgut: Its Use in Gynecologic Operations," Am. Jour. Obst., New York, 1887, xx, 1009-1021.

in 1887, report respectively 9 and 56 prolapsus operations consisting of anterior and posterior colporrhaphy performed at the same sitting. Phillips,¹ in 1888, and Candia,² in 1889, each reported a case of several plastic operations performed at one sitting.

Mundé,³ in 1889, was the first to write upon combined operations in gynecology under a direct caption. He reports 19 Alexander operations in which a lacerated cervix or perineum, or a prolapsed anterior or posterior wall, or a fistulous bladder, was operated upon at the same sitting, and relates that he did trachelorrhaphy and anterior and posterior colporrhaphy at one sitting fifteen years previously. He goes on to narrate that, nevertheless, he did not advocate combined operations in 1885, but had now changed his mind, having overcome the technical and other objections.

From this time on the performance of a number of plastic operations upon a woman at the same sitting rapidly became the common property of gynecologists of standing, although but two articles containing the legend "combined gynecologic operations" in their title, those of Coe⁴ and the author,⁵ have appeared in the literature. It is not too much to say that no operator of the present day is entitled to lay claim to the designation of an expert in gynecology who is unable, as a rule, almost without exception, to perform at one sitting all the plastic work required in any given case.

The more common operations coming under this class include curetage, amputation of cervix, trachelorrhaphy, anterior, posterior, and lateral colporrhaphy, perineorrhaphy, liberation of preputial adhesions, excision of urethral caruncles, torsion of the urethra, repair of vesicovaginal and vesicorectal fistulæ, dilatation of the anal sphincter, operations for anal fissure and fistula, and for hemorrhoids.

II. Plastic Operations Combined with Operations upon the Uterus, its Adnexa, and the Vermiform Appendix, Involving either Abdominal or Vaginal Section or Both.—Combined operations for the cure of prolapse of the uterus and vagina furnish a large contingent of the class of operations under discussion. Combined prolapsus operations are for practical purposes divisible into four principal groups. The first group comprises plastic operations *solely*, in various combinations; the second group includes various plastic operations joined to ventral fixation of the uterus; the third group embraces the same plastic operations with the addition of vaginal fixation of the uterus; the fourth group, finally, is made up of cases of total extirpation of the uterus combined with plastic operations upon the vagina and perineum.

¹ Phillips, J.: "On Ventral Fixation of the Uterus for Intractable Prolapse." *Lancet*, London, 1888, ii, 760-762.

² Candia, F.: "Sulla cura radicale operativa del prolasso totale della vagina e dell' utero," etc., Morgagni, Milano, 1889, xxxi, 612-647.

³ Mundé, P. F.: "Combined Operations in Gynecology," *New York Med. Jour.*, 1889, xlix, 534-536.

⁴ Coe, H. C.: "Combined Operations for the Cure of Procidentia uteri," *Am. Gynec. and Pædiat.*, Phila., 1889-90, iii, 373-375.

⁵ Edebohls, G. M.: "Combined Gynecologic Operations," *Am. Jour. Med. Sci.*, Phila., 1892, n. s., civ, 262-280.

The first group mentioned has already been sufficiently discussed under I.

Ventral Fixation of Uterus Combined with Plastic Operations.—As regards the performance of prolapsus operations of the second group, plastic operations combined with ventral fixation, Mundé¹ appears to have been first in the field. On February 20, 1889, Mundé in a case of prolapsus repaired a lacerated cervix, perforated the uterus by a sound, and performed ventral fixation, anterior and posterior colporrhaphy. He adds that he performed two further operations of the same character in 1889. In April, 1890, Küstner² performed ventral fixation and posterior colporrhaphy at the same sitting; in May, 1890, according to Audry,³ Laroyenne did anterior colporrhaphy and ventral fixation simultaneously; and in December, 1890, the writer⁴ at one sitting performed curetage, amputation of cervix, anterior colporrhaphy, ventral fixation, and perineorrhaphy upon a patient with complete prolapsus. Since that time plastic operations combined with ventral fixation have been repeatedly performed by a number of operators, among others Villar,⁵ Werder,⁶ Krusen,⁷ Noble,⁸ with gratifying results. The repair work, if properly accomplished, will even stand the strain and test of subsequent pregnancy, as evidenced in a case reported by the author⁹ and in a few additional isolated cases scattered through the literature.

In performing combined ventral fixation and plastic operations, Küstner, Fraenkel and with them probably the majority of writers prefer to do the ventral fixation first, following with the plastic work. It is to be noted, however, that the operators who proceed in this manner do not include curetage and amputation of the cervix in their programme. In view of the almost universally acknowledged efficacy of amputation of the cervix as an adjuvant to other operations for prolapse, we may infer that amputation of the cervix is omitted by those operators who do ventral fixation first, largely on account of the difficulty of amputation when performed *after* ventral fixation.

The method followed by the writer is to perform, in the order given, curetage, amputation of the cervix, anterior colporrhaphy or bilateral lateral colporrhaphy, perineorrhaphy, and finally ventral fixation. The main reason urged for per-

¹ Mundé, P. F.: "The Surgical Treatment of Retroversion and Prolapsus," Am. Jour. Obst., New York, 1891, xxiv, 1281-1292.

² Gruenberg, J.: "Ein Beitrag zur Behandlung complicirter Retroflexionen u. Prolapse," Dorpat., 1890, Schnakenburg.

³ Audry, C.: "Note sur trois observations d'hysteropexie pour prolapsus uterins; exécutée par M. le Pr. Laroyenne; emploi d'un procédé nouveau," Progrès med., Paris, 1890, 2, s., xii, 1.

⁴ Edebohls, G. M.: "The Operative Treatment of Complete Prolapsus Uteri et Vaginæ," Am. Jour. Obst., New York, 1893, xxviii, 68-74.

⁵ Villar: "Prolapso completo del utero; raclage; colporafia anterior; colporafia posterior; perineorafia; histeropexia," An. asist. pub., Buenos Ayres, 1891-92, ii, 415-421.

⁶ Werder, X. O.: "The Treatment of Prolapsus Uteri," Penn. Med. Jour., Pittsburgh, 1898-99, ii, 240-244.

⁷ Krusen, W.: "Treatment of Uterine Prolapse with Illustrative Cases," Am. Gynæc. and Obst. Jour., New York, 1897, xi, 553-562. Discussion, 591-595.

⁸ Noble, C. P.: "Abdominal Section on a Patient Suffering from Exophthalmic Goiter," Am. Gynæc. and Obst. Jour., 1898, xiii.

⁹ Edebohls, G. M.: "Pregnancy Following Combined Operations for Complete Prolapsus Uteri et Vaginæ," New York Jour. Gynæc. and Obst., 1894, iv, 697-699.

forming ventral fixation first—the greater certainty of asepsis for the abdominal operation—does not hold good with the experienced operator who knows how to secure and maintain a safe asepsis under much more trying conditions.

Vaginal Fixation of Uterus Combined with Plastic Operations on the Cervix, Vagina, and Perineum.—This method, with which the author has had no personal experience, is a natural extension of the principle of vaginal fixation for retroversion, came into vogue soon after the latter, and is advocated mainly by the original proposers and elaborators of vaginal fixation for retroversion, Schuecking, Mackenrodt, and Dührssen. A. Martin is the most prominent of the few who followed their lead. The vast majority of gynecologists the world over will have nothing to do with vaginal fixation. The sequence of prolapsus operations in which vaginal fixation is combined with plastic procedures is the perfectly natural one of doing the deeper work first, gradually approaching and finishing with the vaginal outlet.

Vaginal Hysterectomy with Combined Vaginal and Perineal Plastic Operations.—According to Theilhaber,¹ vaginal hysterectomy for prolapsus, proposed as long ago as 1757 by Oakley, of Birmingham, England, was first carried out in an uncomplicated case by Chopin, in 1867. Isolated experiences subsequent to the latter date soon proved that vaginal hysterectomy in itself was not sufficient to cure prolapse. As far as my researches go, Martin appears to have been the first to add plastics on the vagina and perineum *at the same sitting* with vaginal hysterectomy for prolapsus. His example was followed by MacMonagle,² who, in 1892, reported nine cases of his own of vaginal hysterectomy for prolapse combined with anterior colporrhaphy and perineorrhaphy, all operations being performed at one sitting in the last three cases. In rapid succession Edebohls,³ Smith,⁴ Boeckel,⁵ and Walker⁶ contributed cases to the literature. The author⁷ believes he was the first to advocate and practise bilateral colporrhaphy and perineorrhaphy joined to total extirpation for the cure of complete prolapse of the uterus and vagina, on several occasions removing ovaries, tubes, uterus, vaginal and perineal flaps, all in one piece.

Chronic appendicitis is so common among women, especially as a concomitant

¹ Theilhaber, A.: "Ueber Prolapsoperationen," *Monatschr. f. Geburtsh. u. Gynäk.*, Berlin, 1897, v, 488–500.

² MacMonagle, B.: "Vaginal Hysterectomy, Colporrhaphy and Colpoperineorrhaphy for Procidentia," etc., *New York Jour. Gynec. and Obst.*, 1892, ii, 1040–1042.

³ Edebohls, G. M.: "Complete Prolapsus of Uterus and Vagina; Total Inversion of Cervix; Vaginal Hysterectomy, Lateral Colporrhaphy and Perineorrhaphy at One Sitting; Cure," *New York Jour. Gynec. and Obst.*, 1893, iii, 517–519.

⁴ Smith, A. L.: "Case of Severe Procidentia Uteri Cured by Vaginal Hysterectomy and Plastic Operations on the Vagina," *Canada Med. Rec.*, Montreal, 1893–94, xxii, 145–147.

⁵ Boeckel, J.: *Assoc. franc. de chir. Proc.-verb.*, Paris, 1896, x, 647–654.

⁶ Walker, H. O.: "Report of an Operation for Relief of Complete Procidentia of the Uterus and Bladder," *Med. News*, New York, 1897, lxxi, 17.

⁷ Edebohls, G. M.: "The Operative Treatment of Complete Prolapsus Uteri et Vaginae," *Am. Jour. Obst.*, New York, 1863, xxviii, 68–74. "Complete Prolapsus of Uterus and Vagina; Total Inversion of Cervix; Vaginal Hysterectomy, Lateral Colporrhaphy and Perineorrhaphy at One Sitting; Cure," *New York Jour. Gynec. and Obst.*, 1893, iii, 517–519.

or result of movable right kidney and of inflammatory disease of the adnexa, that removal of the appendix will often be called for in combining plastic work upon the lower genital tract with abdominal section for either ventral fixation or the surgical treatment of diseased adnexa. The surgeon, indeed, should never fail to assure himself, by direct inspection, of the condition of the appendix whenever the abdomen is opened anywhere in the vicinity of that organ.

Plastic work of every kind is frequently combined with celiotomy undertaken for the performance of various operations upon the uterus, tubes, and ovaries. To even state all possible combinations of this character would be almost impossible and of no practical utility.

III. Plastic Operations, Celiotomy and Colpotomy Combined with Shortening of Round Ligaments, Nephropexy, and Herniotomy.—The progress of modern gynecology calls for a brief consideration of the topic stated. Plastic operations combined with shortening the round ligaments has been practised for the cure of prolapsus almost since the advent of Alexander's operation. Doleris,¹ Mundé,² the author,³ and others, have reported a number of such cases. Curetage, appendicectomy, and shortening the round ligaments performed at one sitting has been a very frequent combination in the author's practice.

The intimate associations between movable kidney and the special diseases of women frequently indicate the performance of nephropexy in combination with operative work upon the uterus, vagina, etc. When the nature of the work upon the genital organs is not too extensive or serious, nephropexy may be added at the same sitting, as has repeatedly been done by myself. A rather complex combination of operations of this category is reported by Montgomery.⁴

In the same manner the gynecologist will frequently be called upon to operate for the radical cure of one or more of the varieties of hernia in connection with gynecic surgery proper. Each case must be a law unto itself as far as combining herniotomy with gynecologic operations at the same sitting goes. The radical operation for inguinal hernia and the inguinal operation for femoral hernia in conjunction with shortening the round ligaments are familiar examples.

History.—Combined gynecologic operations are of very modern origin and previous to about fifteen years ago were scarcely ever mentioned, let alone performed. Their early history, which is practically identical with the early history of prolapsus operations, has already been sufficiently indicated. Even at the present day the largest field of combined gynecologic operations lies in the surgical treatment of retroversion and of prolapse of the uterus and vagina. An article pub-

¹ Doleris: "Traitement des déplacements utérins," etc., Cong. franç. de chir. Proc.-verb., etc., Paris, 1888, iii, 625.

² Mundé, P. F.: "Combined Operations in Gynecology," New York Med. Jour., 1889, xlix, 534-536.

³ Edebohl, G. M.: "The Operative Treatment of Complete Prolapsus Uteri et Vaginæ," Am. Jour. Obst., New York, 1893, xxviii, 68-74.

⁴ Montgomery, E. E.: "Removal of Urethral Caruncle; Curetment; Amputation of Posterior Lip; Hysteropexy; Nephropexy of Right and Removal of Cyst of Left Kidney," Am. Gynæc. and Obst. Jour., New York, 1898, xii, 509-512.

lished by the author in 1892¹ was among the first, if not the first, to call for an extension of the principle so as to embrace operations other than those performed for retroversion and prolapse. Since then the principle involved has obtained more general although, in my opinion, still insufficient recognition.

Conditions for Which Performed.—Combined gynecologic operations, as just stated, are performed in large part for the cure of retroversions and prolapse; in large part, also, for the repair of parts damaged by childbirth, and for miscellaneous conditions. For the *clinical history, etiology, pathology, and diagnosis* of the conditions named the reader is referred to the proper chapters of this book. The *technic* of the individual operations entering into any given combination will likewise be found described in the chapter treating of each operation.

Indications and Contraindications.—The indications for combining a number of gynecologic operations at one sitting may be broadly stated to lie in the avoidance of the necessity of repeated anesthesia, and in the gain of time and lessening of expense for the patient. An additional reason for performing all required operations at one sitting, which pertains especially to prolapsus operations, is contained in the fact that where the operations are spread out over two or more sittings the results of the operation first performed may be nullified or marred while awaiting the second sitting. The various operations entering into combination in the treatment of prolapsus, being intended to be mutually supporting and adjuvant, should *all* be performed at one sitting.

Each operator who frequently performs gynecologic operations in combination has probably set for himself a time limit of safe anesthesia beyond which he is unwilling to protract operative procedures. In the author's opinion the time limit of safe anesthesia, in elective operations, should not exceed one and a half hours.

The contraindications to the performance of combined gynecologic operations are those that pertain to operations in general, such as are found in diseased conditions of the patient's heart, lungs, kidneys, and other vital organs. If combined operations become necessary by reason of a vital indication, a certain measure of risk connected with the patient's general condition may be taken which would, as a rule, be unjustifiably assumed when the operative procedures are not necessary to save life. The author, in common with nearly every operator, has frequently found operations on a non-vital indication called for in the presence of chronic cardiac, pulmonary, or renal disease, and Noble² has recently reported the elective performance of combined operations for prolapsus on a patient suffering from exophthalmic goiter.

As regards the order of performance of the individual operations entering into any given combination no general rule can be given. Each operator's method will vary with his particular technic of the individual operations, his views as to the practicability of maintaining asepsis better in one way than another, etc. Perhaps

¹ Edebohls, G. M.: "Combined Gynecologic Operations," *Am. Jour. Med. Sci., Phila.*, 1892, n. s., civ, 262-280.

² Noble, C. P.: "Abdominal Section on a Patient Suffering from Exophthalmic Goiter," *Am. Gynec. and Obst. Jour.*, 1898, xiii.

one rule only holds invariably good, *i. e.*, when an operation upon the rectum enters into the combination such operation should be performed last.

Literature.—As already stated the literature of combined gynecologic operations is to a great extent identical with that of prolapsus. Very few publications have dealt directly with the subject of combined gynecologic operations in general. It is believed that all of these will be found included in the references already given, while of the prolapsus literature only the principal publications which deal with the *operative* treatment by *combined operations* are noted. A very exhaustive discussion on the surgical treatment of prolapse, with papers by a dozen or more of the foremost French surgeons of the day, is to be found in "Assoc. franc. de chir. Proc.-verb.," Paris, 1896, x, 610-710.

CHAPTER VIII.
DISEASES OF THE BLADDER AND URETHRA.

BY GUY L. HUNNER, M.D.

HISTORICAL.

The past century was replete with investigations and inventions leading up to the precise methods now used in the study and treatment of urinary diseases. In 1806 Bozzini, of Frankfort,¹ originated the hollow speculum and made use of the mirror in light reflection. He described and illustrated specula for the posterior nares and throat, for the vagina, rectum, and female bladder. In addition to this description, his interesting paper is devoted to a philosophic dissertation on the possible uses of his inventions. Nothing is said to indicate an actual application of these instruments.

Ségales, of Paris, in 1828 published a most valuable treatise entitled "*Traite des Retentions D'Urine*," incidentally describing (p. 89) his "urethro-cystic speculum," which he illustrated in a separate atlas. From notes on page 90 of this work it would seem that Ségales used both air and water as means of bladder distention during the cystoscopic examination. His speculum, a small tube, was similar to the one employed later by Grünfeld, and to the one in common use today as the Kelly speculum. He even anticipated Nitze in the use of a mirror in the speculum for the reflection of the object.

Desormeaux made considerable practical use of an instrument which he described to the French Academy in 1852.² His work, "*De L'endoscope et de ses applications au diagnostic et au traitement des affections de l'urethra et de la vessie*," published in 1865, contains a description of the instrument and details much excellent work accomplished. He made use of irrigations to cleanse the diseased bladder just before the endoscopic examination, and, like Ségales, he took advantage of water distention during the cystoscopic examination, but he seems not to have used air distention. He describes the interureteric ridge, but speaking of the ureteral openings, he says (p. 160): "As for these orifices I need not tell you that one cannot distinguish them." While his instrument simplified manipulation by always keeping the light in the same relative position to the endoscopic tube, his lamp attachments must have become hot, and, at best, have been awkward to handle. Although his records of attainment are very satisfactory, he introduced no new principle,

¹ Lichtleiter, eine Erfindung zur Anschauung innerer Theile und Krankheiten, *Journal der practischen Heilkunde*; Hufeland, Berlin, 1806.

² *Bul. de l'Academie de Médecine*, 1852; *ibid.*, 1855.

and I think the instruments of Ségales would today be considered more simple and effective. Both Ségales and Desormeaux were chiefly interested in the male urethra and bladder, and their specula were longer than would be consistent with the best work in the female.

In 1875, G. Simon, of Rostock,¹ was the first to catheterize the ureter. He found that the female urethra can without permanent harm be dilated to a diameter of 2 cm., if the external orifice is first incised on either side and these incisions sutured later. In dilating the urethra he used a series of conical specula with obturators, and by means of the specula the bladder mucosa was explored. But he used no means of distention and found that a finger exploration was more satisfactory than the visual. Under guidance of the palpating finger he succeeded many times in passing a metal catheter into the ureter.

Rutenberg, of Vienna,² used air distention of the bladder and made use of the head-mirror and a gas or oil lamp suspended above the symphysis pubis. He used a very large speculum introduced with its obturator; and after withdrawal of the obturator, a screw-cap, provided with a glass window and a small tube through which air could be forced, was fitted over the outer end of the speculum. In the work of Simon and of Rutenberg it was necessary to have the patient under complete narcosis.

In 1877 Grünfeld, of Vienna,³ returned to simple instruments and methods. He used various modifications of a simple cylindric tube with a funnel form ocular end; in other words, his instruments were very similar to those of Ségales and of Simon, differing from Simon's in being smaller and cylindric instead of conical. For illumination he employed either daylight, gas, petroleum, magnesium, or electricity, and used a head-mirror. He was the first to sound the ureters by the aid of sight, having accomplished this by passing the sound through the urethra beside his cystoscope, and inserting it in the ureter under direct vision.

Among the instruments in use by Grünfeld was the straight hollow tube with open end which was inserted with the aid of an obturator, or, as he called it, a conductor. After withdrawal of the obturator the bladder wall was examined, section by section. To obviate this slow method he made use of water distention, and instead of an open tube with obturator he used a tube closed at its bladder end with glass. This distal end was made oblique to facilitate its insertion. Another of his cylindric tubes was fitted with a lateral glass window; and opposite this, within the tube, was a mirror set obliquely to reflect the light rays and to gather the rays from illuminated portions of the bladder. Grünfeld used for the male both open and windowed tubes made of greater length and with the prostatic curve.

Skene,⁴ of Brooklyn, in 1878 described "An Endoscope for Examination of the Urethra, Bladder, Rectum, etc." This consisted of three parts: (1) a glass tube like the chemist's test-tube; (2) a mirror with handle attached; and (3) a hard-rubber

¹ "Ueber die Methoden die Weibliche Urinblase zugänglich zu machen und über die Sondirung der Harnleiter beim Weibe," Sammlung klinischer Vorträge; Volkmann, Leipzig.

² Deutsche Zeitschrift für practische Medicin, 1876.

³ "Die Endoskopie der Harnrohre und Blase," Deutsche Chirurgie, 1881.

⁴ N. Y. Med. Jour., 1878, xxvi, p. 508.

tube similar to the glass one in shape and fitting over it, having near the closed extremity a fenestra, through which applications could be made to diseased points.

From his "Lehrbuche der Kystoskopie," published in 1889, we learn from Nitze that in 1876 he began his studies which led to the epoch-making achievements in cystoscopy. He introduced two new principles as necessary to further progress in examinations of the hollow viscera of the body: first, the use of a light within the viscus, and, second, the widening of the field of vision.

Pawlik,¹ of Prague, introduced the first practical method of catheterizing the ureters. This consisted in partially filling the bladder with water, and then in a free-hand manner searching for the ureteral orifice with a metal ureteral catheter.

In 1893 Kelly, of Baltimore, first made use of posture for the air distention of the bladder, thereby inaugurating the most recent and most fertile epoch in cystoscopy in women.

HISTORY TAKING AND EXAMINATION.

Anamnesis.—An intelligent patient with disease of the urinary tract can often give a clue to the correct diagnosis by her history. The physician should, however, keep in mind a systematic method of interrogation, and thus be able in almost every case to form some idea from the history as to the location and nature of the disease.

Briefly outlined, such a system of questions might include the following: duration of the present trouble; character of onset and development; was it preceded by any other malady? is it influenced by exercise, body posture, time of day, eating or drinking? frequency of voiding urine, night, day; exact account of a single voiding—incontinence, retention, strangury, duration of voiding, freedom of stream; exact account of pain—location, character, is it before, during, or after voiding? changes in the urine—amount, blood, pus, gravel, air, dermoid cyst contents, gestation sac contents; does the blood appear with the urine or after voiding?

As remote or immediate causes of urinary diseases the patient may be questioned regarding any of the following: hereditary or former diseases, such as syphilis, tuberculosis, gonorrhea, rheumatism, typhoid fever, scarlet fever, or other acute infectious diseases; pelvic or abdominal disorders; traumatic influence, such as exposure, accidents, childbirths, operations, masturbation, wearing of pessaries, attempted abortions. Some patients must be questioned and examined for evidences of nervous affections, such as tabes, myelitis, and neuritis.

The history should include an account of the treatment, general and local, up to the present time.

Examination.—In the examination of patients with symptoms referable to the urinary system it is best in most cases to follow a routine procedure, and to begin with a general physical examination.

General Physical Examination.—The patient is placed in the dorsal position and has the clothing removed or loosened for a thorough examination of the chest and abdomen. The lungs are carefully investigated for evidence of tuberculous infection.

¹ Langenbeck's Archiv, Bd. xxxiii.

The costo-abdominal region is noted with reference to its size and shape and the liability to movable kidney, and for the presence of a renal swelling. An enlarged ureter is often palpable, abdominally, especially as it crosses the pelvic brim. A bladder enlarged from overdistention or from tumor may be seen or felt suprapubically. The pelvic examination begins with inspection of the perineal and vulvar region. Incontinence from any cause may result in eczema extending even as far as the knees. After careful inspection of the vulva and external urethral orifice, and possibly the vagina, the bladder is catheterized and a culture is taken.

Catheterization and Culture Taking.—To cleanse the external urethral orifice before passing the catheter, about one dozen cotton pledgets, soaked in sterile water, boracic acid, or bichlorid solution, should be used. I have demonstrated by a series of plate cultures that there is a direct relation between the number of pledgets used to mop the external urethral orifice and the number of bacteria removed, and that, comparatively speaking, there are very few bacteria left in the external orifice after using ten or twelve pledgets. I have also done enough bacteriologic work on

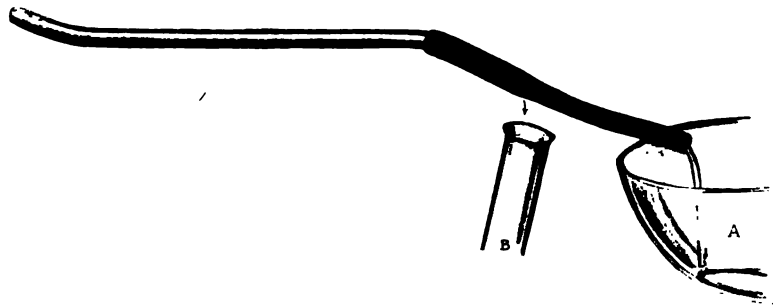


FIG. 237.—THE STERILIZED GLASS CATHETER, PROTECTED BY A RUBBER SLEEVE.

When first introduced, a little urine is allowed to escape into the vessel A; then the rubber sleeve is pulled off, and uncontaminated urine runs directly from the end of the glass tube into the sterile tube B.

the conditions within the female urethra to be convinced that the bacteria so abundant about the external orifice rarely extend far within the urethra.¹

I use a glass catheter, over the distal end of which is fitted a rubber tubing.² This tubing should be large enough to slip from the catheter easily. It is intended for the handling of the catheter from the time it leaves the sterilizing medium until it is inserted in the bladder. After a little urine has escaped the rubber sleeve is removed from the glass catheter and a portion of the urine is then caught in a sterile receptacle or it is allowed to drop directly in the culture-medium. As a rough-and-ready method suitable for the practical requirements of a clinic one may depend upon the slant agar tube for taking the initial culture, using hydrocele agar when a gonorrheal infection is suspected. For scientific investigation with a view of placing the results on record one must use the plate method for taking cultures.

¹ See also Taussig: "Urethral Bacteria as a Factor in the Etiology of Cystitis in Women," *Am. Jour. of Obstetrics*, Oct., 1906.

² See Kelly: "Uncontaminated Urine," *Johns Hopkins Hosp. Bull.*, 1900, xi, p. 91.

The urine is caught in a sterile receptacle, and by means of the platinum loop it is at once carried over to the melted agar tubes and plated. One or two organisms carried from the external urethral orifice on the catheter and floated out again in the urine might cause a profuse growth on a slant agar (because of the water of condensation in the bottom of the tube and the added urine), or propagate myriads of organisms if the sterile receptacle be allowed to stand for some hours before making the plate cultures.

Pelvic Examination.—After catheterization of the bladder the pelvic examination is continued by palpation. The vaginal finger may detect enlargement of Skene's

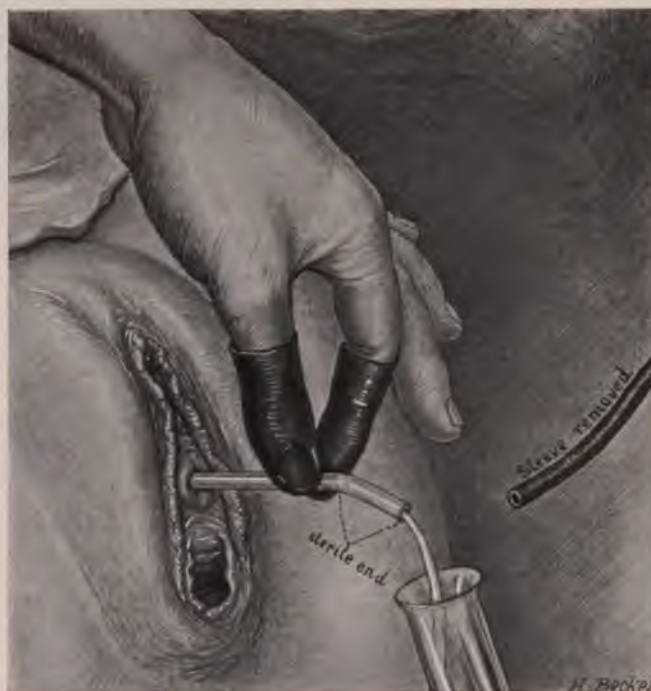


FIG. 238.—SHOWS THE NURSE HOLDING THE CATHETER WITH FINGERS PROTECTED BY STERILE RUBBER FINGER-COTS, WHILE THE URINE ESCAPES FROM THE STERILE END INTO THE GLASS TUBE UPON REMOVAL OF THE RUBBER PROTECTING SLEEVE.

glands, a suburethral abscess, general infiltration of the urethra, or a localized stricture of this organ. A fistula may be felt leading from the urethra, bladder, or ureter into the vagina. Thickening or tumor of the bladder walls, and stone or other foreign bodies in the bladder, are often palpable. A thickened ureter or stone in the ureter may be felt through the vagina or rectum. Bimanual examination is generally employed for palpation of the ureter and bladder, and the degree of sensibility of these organs is sometimes helpful in the diagnosis.

Cystoscopy.—*Contraindications.*—In many cases of urinary disturbance it is unnecessary or inexpedient to use the cystoscope.

The ordinary acute case of post-operative cystitis will usually clear up readily

if the patient drinks water freely, is given urinary antiseptics by mouth, and perhaps has, in addition, a few bladder irrigations. It is usually best in such cases to take a catheterized specimen of the urine for careful estimation of the amount and variety of microscopic contents, and to make a culture.

Evidences of cystitis will often disappear if the patient is placed on internal medication, such as hexamethylene tetramine variously used as urotropin, cystogen, and in more recent combinations. If this treatment fails, the irrigations should be given; and if the cystitis symptoms and evidences still persist, the cystoscope may be used.

Other cases in which the cystoscope should be withheld are those with acute gonorrheal infection. If the symptoms are those of an acute urethritis, and ex-



FIG. 239.—THE TYPE OF KELLY SPECULUM NOW MOST USED.

amination reveals redness of the vulva, redness and swelling of the external urethral orifice, and a purulent discharge containing gonococci, it is wrong to risk infection of the bladder and to add to the pathology of such a case by the trauma incident to instrumentation. After excluding the cases in which it is unnecessary or actually harmful to use instruments internally there still remains a wide range of maladies in which the cystoscope is of the greatest value in making a diagnosis and in the treatment.

Instruments.—In Europe the Nitze cystoscope and its various modifications are still preferred for work on the female urinary apparatus, while in America the Kelly cystoscope and its modifications are still in favor.

One advantage of the Nitze instrument is the ease with which a patient may be

examined while on her back in a comfortable position. With the Nitze cystoscope it is easier to get a thorough view of the anterior wall of the bladder immediately back of the symphysis. Its disadvantages are its expense, the multiplicity of apparatus necessary for its use, and its limitations in the treatment of bladder affections.

Simplicity is the keynote in the use of the Kelly method. The instruments are inexpensive and may be used with no more complicated light than that of the sun or a tallow candle. (See Fig. 239, the type of Kelly speculum now most used.) The most complicated feature of the method is the necessity of using a head-mirror, and every student should have or cultivate some dexterity in the use of the reflected light. If one wishes to do away with the head-mirror the direct head-light may be used (see Fig. 240), but here again is introduced the necessity of electricity and expensive apparatus subject to frequent annoying complications.

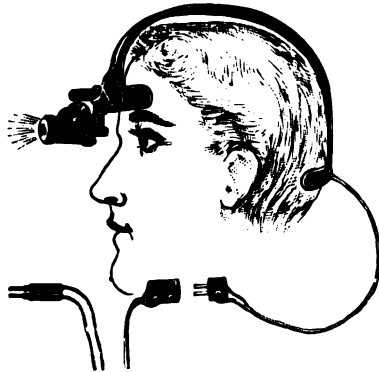


FIG. 240. — SHOWING USE OF THE DIRECT HEAD-LIGHT.

Postures of Patient.—In using the Kelly cystoscope the patient may remain on her back, but in this case must have the hips elevated either by the use of sand-bags under the hips or by use of the Trendelenburg elevated pelvis position.¹

An easier position, and one in which the patient feels the least exposure, is the Sims or semiprone.² These positions have occasionally been used in Kelly's clinic since his early work on air distention of the bladder, but experience has shown that the posture most effective for the operator and applicable in nearly all cases is the knee-chest. The patient finds this position awkward at first, but with a little experience the posture is easily taken and maintained.

It is probable that most failures in cystoscopic work by use of the knee-chest method are due to the neglect of a few important and essential rules. The principle of this method is to obtain as great evisceration of the pelvis as possible. There should, therefore, be no band or binder of any sort constricting the upper abdomen. The patient should be in the knee-chest and not in the knee-elbow position. The knees should be slightly anterior to a vertical let fall from the hip-joint. The trunk muscles must be relaxed, thus giving the back a downward rather than an upward bow.

After incorrect posture of the patient, perhaps the most fertile source of embarrassment in this work is the failure to dilate either the rectum or the vagina with air before dilatation of the bladder. If the bladder is first dilated its dis-



FIG. 241. — GRADUATED CONE DILATOR.

¹ See Webster: Jour. Am. Med. Assoc., 1902, xxxviii.

² See Sampson: Johns Hopkins Hosp. Bull., 1903, xiv.

tention takes place in the direction of least resistance, which is toward the potentially empty pelvis, or, in other words, toward the base of the bladder. This carries the vesicovaginal septum upward, and with it the ureteral orifices are carried beyond the range of easy vision. On the other hand, if the rectum or vagina, or both, are first allowed to fill with air, the vesicovaginal septum is ballooned ventrally, thus carrying the ureteral orifices downward. Now if the speculum is introduced in the bladder and this viscus is allowed to fill with air, the vesicovaginal septum is carried upward to a considerable degree, but usually it does not rise above a plane which is parallel with the plane of the table; in other words, the ureteral orifices are usually found on a level with or even below the speculum when this is held in a horizontal position.

If the above simple but essential rules are observed, cystoscopy with use of air distention of the bladder will be found an easy method. There are minor points of technic which one learns by experience, and a few of them may be mentioned here.

It is not fair to the patient to keep her in position while one is taking his first lessons in the use of the head-mirror. The cystoscopist should become thoroughly familiar with the necessary instruments and the reflected light by working with an empty paste-board box or other hollow structure before even attempting to examine a patient.

Technic of Cystoscopy.—Having made the general physical examination and taken a culture from the urine, how shall we examine the new patient with the cystoscope? With a pipet cocain in 5 or 10 per cent. solution is introduced in the urethra, and the patient is changed to the knee-chest position. By the time this position is taken the cocain has deadened the more acute sensibility of the urethra, and its external orifice can be stretched to the required size by means of the graduated cone dilator (Figs. 241 and 242). Occasionally the external urethral orifice is found to be one centimeter in diameter, but it generally takes the cone dilator only to the 6 or 8 millimeter mark, and must be considerably stretched before it will take the No. 10 (10 millimeter) speculum. If done gently with a boring motion and with the cone well lubricated this stretching can generally be carried to ten millimeters or even beyond, without pain to the patient, and without splitting the mucosa. If the external urethral orifice is unusually small, or if the surrounding tissues are indurated from previous vulvitis or urethritis, it may be necessary to use a No.



FIG. 242.—DILATING THE EXTERNAL URETHRAL ORIFICE WITH THE GRADUATED CONE DILATOR.

8 or No. 9 speculum for the first examination. One should make it a rule to avoid hurting the patient at the first examination. It is better to be satisfied with only partial examination for the first, and even for the second and third visit, provided the patient's confidence is gained.



FIG. 243.—MEDIAN SECTION, KNEE-BREAST POSTURE, SHOWING THE ANATOMIC RELATIONS OF THE PELVIC ORGANS WHEN THE RECTUM, VAGINA, AND BLADDER ARE DILATED BY ATMOSPHERIC PRESSURE. ALSO THE CURVES OF THE URETHRA (Kelly).

It seems scarcely necessary to give directions for the insertion of the speculum. But the operator must bear in mind the anatomy of the urethra and follow its natural curves (see Fig. 243). The speculum is pointed slightly upward until it engages the external urethra, when its handle is elevated so as to point the barrel downward over

the symphysis pubis. On withdrawal of the obturator and rush of air into the bladder the vesicovaginal wall is ballooned upward, and if the handle of the speculum is dropped its weight will bring the barrel of the speculum up against the base of the bladder, and the speculum is found to take a position about horizontal.

The usual routine of the examination is, first, to sweep the speculum about the entire bladder, noting any mucous membrane changes; second, to examine the vertex carefully for the presence of stone or other foreign body; third, to examine the area immediately back of the symphysis, using the fingers of one hand where necessary to push up the abdominal wall in the suprapubic region; fourth, to carefully examine the trigonum and the regions of the ureteral orifices. If a trigonitis or an ulceration of the trigonum be suspected, it is best to examine this region first, before it has been disturbed by manipulations of the speculum. If the symptoms point to a urethritis a small speculum should first be used and the urethra examined at once before it becomes hyperemic from massage by the speculum.

After one is familiar with cystoscopy the ureteral orifices can usually be located at once without following a definite rule; but for the beginner the directions laid down by Kelly¹ should always be followed. After finishing the general examination of the bladder the speculum is withdrawn until the mucous membrane of the internal urethral orifice begins to close about the inner end of the speculum. The handle is then tilted upward and the speculum is pushed in toward the center of the bladder for a distance of about three centimeters. The handle is then depressed in order to bring the inner end of the speculum to a plane with the base of the bladder, and under guidance of vision the speculum is swept to the side until the ureteral orifice is located. This is usually in the arc of an angle of between 15 degrees and 30 degrees from the mid-line. The left ureteral orifice should be sought first, for in the majority of cases it is more easily found, owing to the depression of the left vesicovaginal wall by the weight of the uterus and the cervix² (see Fig. 243). For the same reason the left orifice is slightly nearer the internal urethral orifice than the right. The air-pressure carries the right orifice farther up toward the sacrum and flattens the mons ureteris of this side.

When searching for the ureteral orifices the most helpful landmark is the interureteric ridge. If after following the above directions the ureteral orifice is not found, one should not proceed in a haphazard manner to search for it, but should first orient himself with reference to known landmarks, such as the internal urethral orifice and the interureteric ridge. If the inner end of the speculum is found to be resting on the ridge, the probabilities are that the speculum has been pushed in the bladder to the proper distance, and that the ureteral orifice will be found either laterally or medianward from the area first inspected. If the interureteric ridge is seen to lie at some distance beyond the end of the speculum, we know that the speculum has not been pushed far enough from the internal urethral orifice; whereas,

¹ "Operative Gynecology."

² Hunner and Lyon: "Mensuration and Capacity of the Female Bladder," Jour. Am. Med. Assoc., Dec. 16, 1899.

if the ridge is nowhere in the field of vision, it is because the speculum has been pushed in too far. The experienced cystoscopist grasps these clues and readily corrects his first location; but for the beginner it is often a saving of time to withdraw the speculum to the internal urethral orifice and to again follow the prescribed routine.

I wish to call attention to a second ridge in the bladder which I have not seen

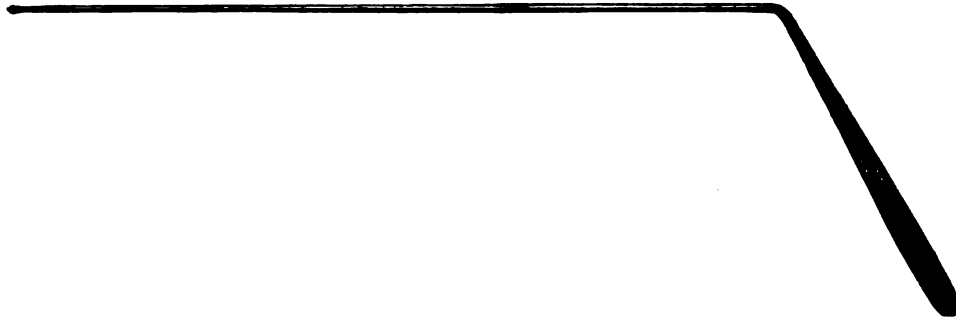


FIG. 244.—URETERAL SEARCHER ($\frac{2}{3}$ USUAL SIZE).

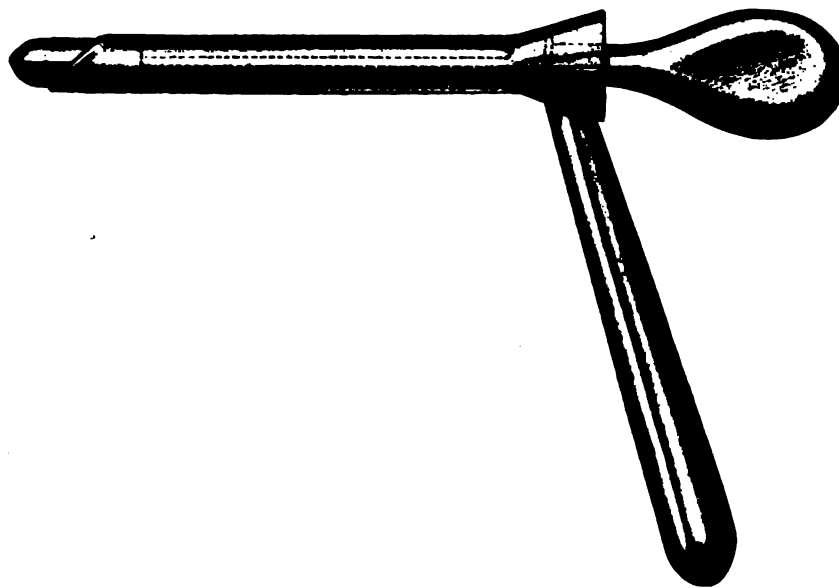


FIG. 245.—SPECULUM WITH OBLIQUE END FOR COLLECTING THE URINE DIRECTLY FROM THE URETER.

mentioned by cystoscopists, and which may readily confuse the beginner. This I call the vesicouterine fold, as it corresponds to the vesicouterine sulcus outside of the bladder. It is a transverse ridge or fold of the bladder mucosa situated about three centimeters back of and running parallel with the interureteric ridge. It is most marked in women who have borne several children, and in some very relaxed cases there are one or two small accessory ridges running parallel with the main

vesicouterine fold. My first experience with this fold was a patient attempt one day to locate the ureteral orifices on a well-marked ridge, and on withdrawal of the speculum to find the internal urethral orifice so as to begin the search again, I was surprised to find the real interureteric fold about half-way between the fold I had been examining and the internal urethral orifice. Frequently one is led to the exact location of the ureter by seeing a spurt of urine, even though the speculum may be at some distance from the orifice.

The ureter generally enters the bladder on a papilla-like elevation of the mucosa, the so-called "*mons ureteris*." This, as already stated, is often more prominent on the left than on the right, and it is generally most developed in women who have borne children. In nulliparæ the mons is frequently absent, and instead of an elevation of the mucosa there may be a saucer-like depression. When the ureter is shortened from any cause, especially in the inflammatory thickening of tuberculosis, the orifice may be retracted. At times one finds a vessel circumscribing the ureteral orifice, or one or more vessels may radiate from the orifice not unlike the retinal vessels about the optic disc.

Should the base of the bladder be the seat of inflammatory changes the ureteral orifice may be difficult to locate because of alteration in both the immediate and distant landmarks. One is sometimes compelled to hunt for the orifice with the ureteral searcher (Fig. 244). The inflammatory swelling may interfere with the jet-like action of the urine, but with a little patient watching one can generally catch the light reflection as the urine spreads over the mucosa, and in this manner the orifice may be located without the use of the searcher. To collect urine from a kidney when for any reason it is undesirable to catheterize the ureter, we make use of the cystoscope with oblique distal end (see Fig. 245), such as originally shaped by Grünfeld. This can be held to cover the ureteral orifice more easily than the cystoscope with the ordinary square end.

The *catheterization of the ureter* is a simple matter after its orifice is located, and special rules are not necessary. If the hands are surgically clean the renal catheter may be grasped at any portion, but if the hands are septic the catheter must be grasped near its outer end at a point that is not to reach as far as the urethra with the catheter at full insertion. The renal end may be guided into the speculum by an assistant who handles it with sterile forceps. An assistant is not absolutely necessary,



FIG. 246.—THREE-FINGERED RUBBER GLOVE.
For handling sterile renal catheter.

for the stilet stiffens the catheter sufficiently to enable the operator to handle it from the distal end.

If one wishes to grasp the catheter near the speculum and still be certain of a good technic, a rubber glove for the thumb and first two fingers (see Fig. 246, this can be cut from an old operating glove) is easily slipped on, and by keeping this already sterilized, powdered, and wrapped in a sterile towel, the operator can first locate the ureteral orifice and then have the assistant draw the glove over his catheter hand, either right or left. It is well always to wear the head-mirror over the eye opposite the hand used in catheterizing, to avoid touching the edge of the mirror with the catheter as it is pushed past the operator's head.

DISEASES OF THE URETHRA.

In spite of its simple anatomy and its limited field of pathology, the amount of suffering caused by this organ demands a thorough study of and familiarity with its diseases.

The specialist in urinary diseases is not infrequently consulted by patients who for years have suffered with some affection of the urethra because the attending physicians have failed to recognize the disease. The history in an individual case of urethral trouble may be very atypical; and with any complaint of pain or discomfort in the pelvis or lower abdomen in which the anatomic cause is not readily found, an examination of the urethra should not be neglected.

Anatomy.—The urethra is a tubular structure having an average length of 3.5 centimeters. In the erect body posture its direction is almost vertical, and in its course from the bladder to the vulva it possesses a slight posterior convexity. Waldeyer¹ divides the urethra into three sections: the *pars intramuralis*, which really corresponds to the short funnel-shaped internal urethral orifice; the *pars superior or libera*, a mobile portion extending one centimeter away from the bladder and imbedded in loose connective tissue; and the *pars inferior or vaginalis*, the outer two-thirds of the urethra, which is intimately connected with the vagina by fibromuscular tissue forming the urethrovaginal septum.

Under normal conditions the internal urethral orifice lies back of the mid-portion of the symphysis pubis at a distance of 2 to 2.5 cm. The inferior portion of the urethra normally lies from 1.5 to 2 cm. from the pubic arch. The external orifice or *meatus urinarius* lies about 2 cm. below the base of the clitoris. It is usually a vertical slit, but it cannot be said to possess a characteristic form, because of two or more wing-like folds of mucous membrane, the *labia urethræ*, which are often present and which cover the meatus in a variety of ways. When the *labia urethræ* are present, as is usual in women who have not borne children, they often fold in such a manner as to form a mound-like projection in the vestibule, the *papilla urethralis*. The external orifice averages about 7 mm. in diameter.

The mucous membrane of the urethra with its submucosa is particularly rich

¹ "Das Becken," Bonn, 1899.

in fibroelastic tissue, and the submucosa layer is more or less intimately interwoven by the muscle layers. The epithelium is of the stratified squamous type, and the free surface of the mucous membrane is beset with papillæ, particularly in the distal portion of the urethra. When the organ is at rest the mucous membrane lies in longitudinal folds, and between these folds on its inferior or vaginal wall are numerous openings arranged longitudinally in groups. These are the mouths of mucous glands which dip into the fibroelastic layer and correspond with Littre's glands in the male. They vary from the simplest tubular recesses or inversions of the mucous membrane to the most complex racemose glands. The glands tend to increase in size and complexity toward the outer end of the urethra, and the group situated at and just within the meatus are described by Luschka as being of the racemose type. These glands have been known since their description by Morgagni, but Skene,¹ of Brooklyn, was the first to study them carefully and to call attention to their pathologic significance. He described a pair of very large glands, the mouths of which open on the urethral mucosa just within or upon the *labia urethræ* (see Fig. 247) and whose comparatively wide tubules extend upward on either side of and parallel to the urethra for a distance of from 9 to 18 millimeters, where they end in numerous blind pockets and saccules. Schuller² described these glands in great detail, and he occasionally found a third but smaller gland or tubule lying in the middle line between the other two.



FIG. 247.—HAIRPIN SPECULUM EXPOSING THE ORIFICES OF SKENE'S GLANDS.

Outside the fibroelastic layer of the mucous membrane is the muscular layer, which, according to Luschka, is made up of two planes of smooth muscle, an inner longitudinal and an outer circular plane, and two planes of striated muscles. The circular layer of smooth muscle is closely related to the musculature of the *trigonum vesicæ*. It continues throughout the length of the urethra as the *lissosphincter urethræ*. An independent ring of smooth muscle fibers helps to form the *sphincter vesicæ*. The

¹ Am. Jour. Obstet., 1880, xiii.

² "Ein Beitrag zur Anatomie der Weiblichen Harnröhre," Festschrift für Bernard Schultze, Berlin, 1883, 4, S. 16.

striated muscle, according to Uffelmann,¹ sends longitudinal fibers down the posterior and lateral walls of the proximal half of the urethra, and these gradually leave the urethra for the lateral vaginal walls; while the circular fibers are confined to the *sphincter vesicæ* and its immediate vicinity over the urethra. These striated muscles arise from the deep triangular muscle of the perineum.

Interweaving the muscle bundles and elastic fibers and surrounding the groups of urethral glands are the plexuses of large veins lying in the urethropubic space on either side of the urethra. These veins are directly continuous with the *bulbus vestibuli vaginæ* and with the cavernous plexus of the clitoris.

The arterial supply comes from two sources. The internal pudic sends branches to the distal portion, while the cervicovaginal branch of the uterine sends twigs to the upper and middle urethra.

The lymph-vessels of the lower urethra, according to Sappey, join the lymphatics of the labia minora and thence empty into the inguinal lymph system.

The nerve-supply to the striate muscles comes from the internal pudic, and the smooth muscles are innervated from the pelvic sympathetic.

Pathology.—Diseases of the female urethra may be classified as follows: (1) Malformations; (2) Displacements; (3) Variations in Caliber; (4) Fistulæ; (5) Foreign Bodies; (6) Inflammations; (7) New Formations; (8) Neuroses.

MALFORMATIONS.

Error or arrest of development during embryonic life gives rise to various malformations. Complete arrest of development is called *defectus urethræ totalis*. If the inner or outer end of the urethra fails to develop, the condition is known as *defectus urethræ internus*, or *defectus urethræ externus*, respectively. Should the two ends fail to meet during development, there may be left between them a transverse or oblique septum, and the condition is known as *atresia urethræ*. Partial or entire absence of the inferior urethral wall is known as *hypospadias*. In *hypospadias* the external urethral opening may be situated at any point along the anterior vaginal wall, or the escape of urine may be direct from the bladder into the vagina.

Another form of *hypospadias* is that in which the urogenital sinus persists, with *atresia* of the external vaginal opening. The common external opening is small and corresponds with the urethral meatus. A sound or speculum follows a single canal for a short distance, when two openings are met with, one leading into the bladder *via* a short urethra, and the other leading into the vagina.

Partial or complete absence of the upper urethral wall is called *epispadias*, a not uncommon condition in exstrophy of the bladder.

Symptomatology.—*Defectus urethræ totalis* has the associated phenomenon of incontinence of urine. The symptoms of *hypospadias* vary according to the location of the meatus urinarius. If there be entire absence of the inferior urethral wall and an opening from the bladder, the symptoms are the same as in *defectus urethræ totalis*, while with preservation of the bladder sphincter and a distal urethral

¹ Zeitschrift. rationelle Medizin, Bd. xvii, quoted by Luschka.

opening, the patient may have perfect continence, but some difficulty during the act of micturition because of the direction of the stream into the vagina.

With persistence of the sinus urogenitalis and atresia of the vagina the common opening may be sufficiently dilated to admit the penis in coitus, and if this organ enters the vagina pregnancy may follow. Or if the penis follows the superior channel and enters the bladder, symptoms may be absent, or dysuria may occur with temporary incontinence after the sexual act.

If atresia urethræ be present in intrauterine life hydrops of the bladder, ureters, and kidneys may follow and cause the death of the fetus. Or this condition may cause serious or even fatal results from obstruction at labor. A more fortunate outcome is the early escape of the urine through the urachus and the persistence of a urachus fistula through the navel.

Other anomalies of development frequently associated with defect of the urethra, and not yet mentioned, are separation of the symphysis bones, enlarged clitoris and other tendencies to hermaphroditism, such as the presence of the testicles or ovaries in the labia majora. Schatz¹ has reported a case of total fission of the urogenital system.

Treatment.—Each case of congenital malformation presents its peculiar technical problems, and no attempt will be made here to present more than a few general principles governing the treatment.

Defectus urethræ totalis with preservation of the bladder sphincter would perhaps do better without operative treatment. While a new urethra can be made along the anterior vaginal wall, its connection with the bladder opening might result in destruction of the sphincter action. The operation devised by Kelly, and depicted in Figs. 271 and 272, is an excellent one for the restoration of the urethra, particularly in those cases with intact sphincter vesicæ. If the sphincter has a weak action and there is partial incontinence, the electric current may be used to develop and strengthen the sphincter muscles. If with complete absence of the urethra there be a vesicovaginal opening and no sphincter control, the condition should be restored to the normal as nearly as possible by operative measures, and if the control is still unsatisfactory various mechanical devices may be used in making it more perfect. These measures will be discussed more fully under treatment of urethral fistula.

The various forms of hypospadias should be subjected to such plastic work as the individual case demands. Atresia, if accompanied by urachus fistula, may be allowed to go untreated until the child is old enough to make the urethral operation more certain of success. If accompanied by retention, atresia should be treated at once. Simple puncture and dilatation of the septum may be sufficient, but if the location of the inner end of the urethra and the internal orifice be in doubt, it may become necessary to make a small vesicovaginal fistula, and through this to pass an angled probe out into the urethra to serve as a guide in cutting or puncturing from without.

¹ Archiv. f. Gyn., i, p. 12.

DISPLACEMENTS OF THE URETHRA AND PROLAPSUS OF ITS MUCOUS MEMBRANE.

Upward dislocation of the urethra is due to dragging upon the bladder and urethra by tumor of these or adjacent organs, most frequently by pregnancy or fibroid tumor of the uterus. With the upward displacement there may be pressure by the tumor mass or the cervix, and partial or complete retention. It may be impossible to catheterize the patient without first placing her in the knee-breast position.

The **downward dislocations** of the urethra are associated with prolapsus of the anterior vaginal wall, with or without prolapse of the bladder. The condition is most commonly dependent upon childbirth, but it may occur in nullipara, or it may result from tumor formation of the bladder or uterus with prolapsus. A temporary dislocation often occurs during childbirth.

The *symptoms* may be *nil*, or the patient complains of partial or complete retention, or of partial or complete incontinence. Sudden stoppage during urination is not an uncommon symptom, and residual urine after voiding is the rule. The patient sometimes learns to raise the anterior vaginal wall with the fingers while voiding. Infection and cystitis may be present. The diagnosis is made by inspection, the condition being easily exaggerated by having the patient strain, and by passing the catheter or sound and finding the abnormal direction of the urethra. At times it is difficult to pass a catheter without first straightening the urethra by pressure with the finger over the anterior vaginal wall. Lateral displacements of the urethra are congenital or follow injury, most frequently obstetric.

Prolapsus of the mucous membrane may be of slight degree and difficult to differentiate from caruncle or from a swelling of the labia urethræ; or the prolapsus may be of extreme grade, forming a mass the size of a pigeon's egg. According to the circulatory condition the mass may show a bright red or bluish congested mucosa, or it may be necrosing. The usual causes are poor general condition of the patient, with lax tissues, some form of bladder trouble causing strangury, repeated difficult labors, stone in the bladder, and tumor in the urethra. The treatment should first be directed toward reposition of the mass, and then to removal of the cause. If the prolapsus is due to poor general health, rest in bed and tonic treatment are indicated, together with some local styptic, such as copper or zinc sulphate or tannin in weak solutions. Should the condition be of long standing and aggravated character, resection of the prolapsed mucosa may become necessary; but this should not be done until after some days of preliminary treatment directed toward the reduction of the inflammatory condition.

VARIATION OF CALIBER.

We recognize dilatations, narrowing, and strictures of the urethra. A urethral dilatation may be of the entire organ, *dilatatio urethræ totalis*, or it may be of any portion, *dilatatio urethræ partialis*. Dilatation of the entire organ is generally caused by introduction of the penis, and is most frequently found in cases of *atresia vaginæ*. If no venereal disease be present, women with this condition often have

no urinary symptoms, and consult the physician because of sterility or the absence of menstruation. There may be temporary frequency, strangury, or incontinence after the sexual act, or a permanent incontinence may be the chief symptom. Masturbation has caused dilated urethra both in subjects with atresia vaginæ and in women whose genitalia are normal.

The passage of large intravesical bodies, such as stones and tumor masses, often causes temporary dilatation of the urethra. The former practice of wide dilation with instruments or with the finger sometimes resulted in incontinence, and this procedure should be abandoned.

In dilatatio urethræ partialis there may be involvement of only a small portion of the urethral wall, or the entire wall with one of the orifices may be dilated while the other orifice is preserved. G. Simon¹ reports a case in which the entire anterior urethral wall, together with the internal urethral orifice, were widely dilated following a varicose condition of the urethrovaginal veins. I saw a case in which the urethral canal and the external orifice were dilated, due to injury at childbirth, and destruction of the tissues. This patient suffered from partial incontinence, while Simon's patient with dilatation of the internal sphincter had no control over the urine. Cases with urethrocele or partial dilatation of the urethral wall often have no difficulty with control. So-called urethrocele of the urethral wall is undoubtedly more often a dilatation of one of the glands as a retention cyst or an abscess which later bursts into the urethra and remains as a diverticulum of the same.²

Stenosis, stricture, and narrowing of the urethra may be caused by acute or chronic changes in the mucosa or surrounding walls, by tumors of the urethra or periurethral wall, or by tumors or displacements of neighboring organs. An acute gonorrheal urethritis in women may cause such an edema of the mucosa as to result in almost complete retention. A long-standing urethritis from gonorrhea or other causes often results in one or more areas of scar tissue contraction, the true stricture. Chancre of the urethra may cause obstruction, as may carcinoma of the urethrovaginal wall. After gonorrhea, perhaps the most frequent cause of stricture is difficult labor, in which the urethra is torn either by the child or by instruments. Narrowing and complete stenosis are not uncommon from pressure by large myomata. I have observed one case in which there was retention from pressure by the cervix due to prolapsus and retroversion of a normal sized uterus bearing on its fundus a hen's-egg-sized myoma, and another case in which complete retention was due to a large myoma blocking the superior strait of the pelvis. Hematocolpos and hematometra are mentioned by Winckel as causes of urethral obstruction.

FISTULÆ.

Urethrovaginal fistula is rare. It is generally caused by pressure of the head or instruments at childbirth, and the more common condition is destruction of portions

¹ Monatsch. f. Geburtshilfe, 1864, xxiii, pp. 245-248.

² Cullen: Bull. of the Johns Hopkins Hosp., v, p. 45; "Abscess in the Urethrovaginal Septum." Also see Hoffman: Inaug. Dis., Leipzig, 1901, "Beitrag zur Lehre von den Urethral-Divertikeln beim Weibe."

of the bladder, urethra, and vagina together, thus establishing vesicourethrovaginal communication. A suburethral abscess rupturing on the vaginal side or a tertiary gumma may leave a urethrovaginal fistula. Continence depends upon the condition of the sphincter vesicæ, and if the muscle has not been injured the only symptoms may be due to a misdirection of the urinary stream. If troublesome symptoms arise from the fistula it should be operated upon, and for this the same principles hold as in closure of a vesicovaginal fistula, which will be discussed in a special chapter.

The closure of urethral defects in the female is usually not difficult because of the abundance of tissue to be had for plastic work. At times, however, after a prolonged labor in which there has been destruction of the anterior vaginal wall and vestibule tissues, and particularly after former operations in this region, one meets a problem to be solved only by the greatest patience and ingenuity. Fortunately even the worst cases have often a portion of the labia minora which can be utilized in the plastic work. Fig. 270 represents the excellent result obtained in a difficult case in the hands of C. P. Noble.

In repair of the male urethra P. C. Fenwick,¹ of New Zealand, transplanted a portion of a freshly removed urethra from a sheep, and J. H. Pringle, of Glasgow,² used a portion of a bullock's urethra freshly removed and transferred to the operating room in hot normal saline solution. The results were such in the hands of each of these surgeons that this method is to be recommended in the female in extreme cases.

When there is a loss of the internal sphincter the urethra should be made very small and carried out toward the clitoris as far as possible in order to form a mechanical resistance to the loss of urine. Various mechanical devices have been used to secure pressure over the deficient urethra. One of these, devised and successfully used by H. A. Kelly, is shown in Fig. 273.

In a case of carcinoma of the urethrovaginal septum (Gyn. No. 8810) I removed the entire urethra down to the internal sphincter, a large portion of the anterior vaginal wall, the fat and vesicular channels of the labia majora, and the inguinal glands of both sides. The patient had good control for eight days, when the process of healing and scar tissue retraction interfered with the urethral muscle. After six weeks a plastic operation was done to release the tension of the new anterior vaginal wall, and again there was continence until the dragging of the healing tissues again caused leakage through the sphincter. Faithful application of the interrupted galvanic current caused visible development of the sphincter muscle and resulted in perfect control except under unusual circumstances, such as continuous coughing during a bad winter cold, or an unusual strain when the body is in certain positions. Lebedraff³ used the same means with good result on a case of hypospadias after several plastic operations proved only partially successful.

¹ *Lancet*, London, 1896, i, p. 353.

² *Annals of Surgery*, 1904, xl, p. 387.

³ *Archiv. f. Gyn.*, 1880, xvi, p. 290.

Foreign bodies in the female urethra form a topic so closely allied to that of foreign bodies in the bladder that they may be discussed under the latter section.

INFLAMMATIONS.

As nutritional disturbances we recognize hyperemia, catarrh, ulcer, abscess, hypertrophy, and atrophy. These various conditions are frequently different stages of the same process.

Causes.—The normal condition of the urethral mucosa may be altered by causes acting either from within or from without. Very acid or very alkaline urine, and infection from the kidney or bladder, may modify the urethral mucosa. They at least furnish conditions for a urethral lesion if this organ be injured by external influences. Lesions of the urethra are not infrequent in the acute exanthemata, as, for instance, in measles, scarlet fever, variola, and smallpox.

As influences working from without, may be mentioned acute and chronic affections of the vulva, vagina, and cervix. Diphtheria, lupus, tuberculosis, syphilis, and gonorrhea affecting the external genitalia are liable to extend into the urethra.

Traumatic influences, such as dislocations and injuries due to pregnancy, childbirth, coitus, and tumors, are important causes of urethral disturbance. Trauma and infection of childbirth, and particularly gonorrheal infection, often result in the disappearance of the urethral labia and their replacement by scar tissue. Careless catheterization and the use of dirty instruments are often followed by urethritis. We not infrequently see inflammation of the urethra in patients whose external genitalia present evidences of onanism, the urethral lesion being due to a foreign body used in masturbation, or to the repeated excitation of these tissues. Ungratified sexual excitement may result in vulvar and urethral inflammation.

Urethritis.—Because of its frequency we may consider urethritis of a gonorrheal origin as the type, and speak of its pathology, symptoms, and treatment. It is generally secondary to a fresh gonorrheal inflammation of the vagina or cervix. The mucous membrane of the urethra becomes reddened and swollen, and as the edema increases the color becomes darker and it often presents a violet-red or blue color. This early stage is marked by a burning and itching, particularly on voiding, and, finally, as the swelling increases there may be difficulty in voiding amounting to retention. This is perhaps due more to the reflex shrinking from pain than to the anatomic changes.

The discharge during the first few days is of a watery or starchy character, but in from six to eight days it becomes thick and purulent. After the third week there is a regression, and in from four to six weeks the discharge may cease. During the most acute stage, usually at the end of the first week, there may be bleeding from the urethra.

The small mucous glands of the vulva are often infected and their swollen orifices present groups of bright red points in the sulci dividing the labia minora from the urethra. These may go on to abscess formation and ulceration, causing a thick purulent discharge which hides the mucosa of the entire vestibule.

During this stage the patient is generally too sore to allow digital examination, whereas in the later subacute stage the urethra may be palpated as a dense, sensitive ridge; and by making pressure from above downward, a creamy pus is expelled from the meatus. If the process has become chronic the urethral ridge feels more dense and infiltrated, there may be but little sensitiveness, and pus may or may not be present.

A *diagnosis* must be made between gonorrheal, chancroidal, and syphilitic infections. The presence of gonococci in the secretions is accepted as evidence of that disease, but a failure to find this organism is not unusual in the later stages and chronic period of the disease. An infection with the common pyogenic micrococci may cause catarrh and ulceration in a manner very similar to the above and make the diagnosis between gonorrhea and chancroid very difficult.

As aids in the diagnosis of true chancre may be mentioned the more localized character and longer duration of the actue induration, and the presence of buboes in the inguinal glands. Buboes, however, may accompany any of the urethral infections.

As sequelæ of a urethritis one finds the induration, already mentioned, of the entire canal. Induration and shrinkage of one or more localized areas result in stricture. Abscess formation in one or more of the mucous glands may cause a chronic suburethral abscess which fills and discharges pus periodically.

The meatus urinarius may be red, swollen, and everted, showing the bright red orifices of the glands of this region. Abscesses of these glands are generally considered as having formed in one or both of the pair of large glands described by Skene, and they are known as Skene's abscesses. They are often palpable as round, hard masses, about one centimeter in diameter, and very sensitive to the touch. The patient complains of burning, sticking, or shooting pains about the vulva, which often reach a degree of extreme discomfort and then suddenly disappear. Some patients notice with the sudden cessation of pain a discharge of pus, others find that by pressure of the index-finger they can expel pus and relieve the pain. At a later stage Skene's glands are partially or entirely obliterated by inflammatory tissue and are palpable as a pair of thick, tender, elongate ridges.

The most common sequel of urethral blennorrhea is a condition of chronic urethritis. The symptoms are most protean, and we warn our students that when a patient complains of persistent symptoms of whatever character, located anywhere between the coccyx and the umbilicus, for which no other anatomic lesion can be found, they must never overlook the urethra. The symptoms, however, are usually suggestive of urethral trouble, the patient complaining of, among other things, frequent or burning micturition. Endoscopy reveals a congested mucosa. The longitudinal arrangement of the mucosa papillæ may be entirely masked, and replaced by a general congestion of the mucosa, or by a granular surface in which the papillary vessels are exposed, or by an ulcerated condition, usually of a patchy character.

The most frequent picture in a long-standing case is an approximately normal

striated mucosa over the inner third of the urethra, while the outer two-thirds are congested and more or less granular.

The urethritis of masturbation has already been mentioned. Some of these cases present a picture difficult or impossible to diagnose from chronic gonorrhea. The vulva is bright red, there is abundant leukorrhea, a purulent looking material (which microscopically is made up of epithelial cells and bacteria) is squeezed from Skene's glands, and the urethra may be the seat of one or more strictures.

Treatment.—The light cases are self-limited. Cure is hastened by rest in bed, a light diet, and keeping the bowels well opened. Acid and spiced foods and alcoholic drinks must be avoided. Copious bland drinks should be taken, and in the early stages cystogen or salol may be given in small doses as a prophylactic against bladder infection. After the acute symptoms have subsided the volatile oils, such as copaiba, cubeb, or sandalwood, may be given.

Great care should be observed in local treatment during the early stages, particularly in children and unmarried women, where the disease is often confined to the urethra or to the urethra and vulva. In such cases the usual methods of treatment are apt to carry the disease to the bladder or to the upper vagina or cervix. Before beginning local treatment the extent of the disease in the vagina may be determined by careful use of the Kelly cystoscope, the patient having the vulvar orifice thoroughly cleaned and then being placed in Sims' position. If the disease involves the upper vagina irrigations may be used from the beginning, whereas if it is reasonably certain that the disease is confined to the vulva and the urethra there should be local treatment only. This may consist of several vulvar irrigations a day, using silver or mercury solutions or potassium permanganate, and the urethra may be washed twice daily with one of the silver solutions. Protargol in strength of from 0.5 to 5 per cent. and argyrol in from 5 to 30 per cent. solutions have now largely superseded the nitrate of silver, these being solutions of silver which can be used strong enough to destroy the gonococci without doing injury to the tissues. The injections should be given with an ordinary medicine-dropper or pipet, great care being exercised to confine the solution to the urethra and to avoid traumatic injury of this organ. Urethral instillations should never be given except by the physician or trained nurse.

If the patient is suffering from inflammation about the vulva which is not controlled by the irrigation, relief may be obtained by the use of tampons of absorbent cotton or lint soaked in a liniment containing from 5 to 10 per cent. ichthyol and 2 per cent. carbolic acid.

If the disease is not controlled in from six to ten weeks on the above treatment more radical measures may become necessary. A common legacy after acute gonorrheal urethritis is a chronic granular condition of the mucosa. For this, local applications through the cystoscope are most beneficial, and silver nitrate in solutions of from 3 to 10 per cent., applied once or twice a week, is the best form of medication in most cases. When pain and irritation are unusually pronounced in this class of cases the urethral bougie is often efficacious. This can be made up with lanolin softened by a little oil, and to this vehicle one may add opium or cocain

for the immediate effect, and carbolic acid 2 per cent., protargol 5 per cent., or ichthyol 10 per cent., for their healing effect.

If infection of Skene's gland persists, this is best treated by the method recommended by Skene, which consists in first cocainizing the parts and then inserting a fine probe into the gland, depressing this to make the urethrovaginal wall tense, and burning down upon the probe from the vaginal side by means of the cautery blade.

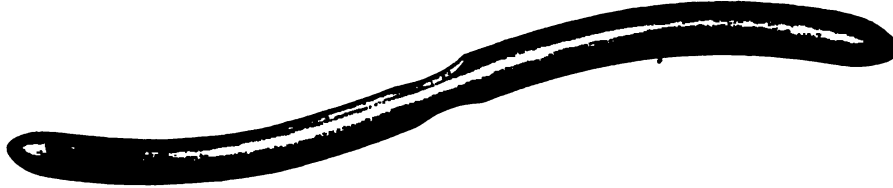


FIG. 248.—HEGAR DILATOR.
Showing sizes 9 and 10 (9 and 10 millimeters).

Stricture of the urethra does not occur until the chronic stage, when it may be treated by gradual repeated dilations, preferably with the Hegar dilators (see Fig. 248). The troublesome symptoms of stricture may not appear, however, until there is a fresh gonorrheal urethritis added to a strictured condition resulting from a former attack. In such a case it may become necessary to make a few dilatations during an acute attack of inflammation or to make a vesicovaginal fistula.

NEOPLASMS OF THE URETHRA.

Tumors of the urethra, while rare, are more common in women than in men.

The most common new-growth is the **urethral caruncle**, a vascular looking tumor occurring at the external urethral orifice. Thin lamella of fibrous stroma project from the papillae of the urethra carrying a rich supply of blood-vessels and being covered by from one to several layers of squamous epithelium. The growth may be represented by a single small red papilla or by several of these, or it may cover the entire external urethral orifice as a raspberry-like tumor and extend for some distance into the urethra. It is either sessile or pedunculate, and it may be exquisitely sensitive, causing the patient to forego sexual intercourse and to dread the voiding of urine, or it may be free of symptoms. Women afflicted with the painful variety of caruncle are forced to avoid exercise and are liable to become nervous and even melancholy.

The *treatment* consists in total extirpation. If the caruncle be small, this is easily accomplished under local cocain anesthesia, but with the larger variety, and particularly for a nervous patient, general anesthesia is preferable. With the cone dilator the external urethral orifice should be thoroughly dilated so as to expose the entire base of the tumor, when it can be easily extirpated with scalpel or scissors, and the wound closed by suture. Extirpation by means of the actual cautery gives excellent results. If the tumor is not completely excised it has a marked tendency to return, and this feature adds to the terror of the nervous woman, in that she thinks it must be of a cancerous nature.

Fibroma of the urethra occurs principally in small children. The tumor is generally found hanging from the posterior margin of the urethra and is easily removed.

Carcinoma may arise in any portion of the urethra; or, by extension from the vestibule, a vaginal or vulvar carcinoma may invade the urethra and cause symptoms of urethral carcinoma. These are itching and burning in the vulva, often heightened by the passage of urine, actual pain on voiding, misdirection of the stream, symptoms of urinary obstruction, spontaneous lancinating pain, and a watery or bloody discharge increased by exercise or by coitus. Any or all of these symptoms may be wanting until a late stage of the disease, and for this reason the occurrence of any of them, especially in a woman past the middle period of life, calls for prompt local examination.

The condition occurs as a papillomatous outgrowth from the mucous membrane of the urethra, as a nodular infiltrating mass usually surrounding the outer end of the urethra, or as an ulcerating excavating process involving both urethra and vaginal wall. In the early stages the papillomatous form must be diagnosed from caruncle, and the infiltrating and ulcerating forms must be differentiated from chancroid, primary sore, and lupus.

The *treatment* consists in excision, giving the growth a wide berth, and in removal of the lymphatic structures extending from the growth out to and including the lymphatic glands of the groin.

In Ehrendorfer's collected list of 27 cases of carcinoma of the urethra, including one case of his own,¹ enlarged lymphatic glands were mentioned in only about one-third of the cases.

Sarcoma of the urethra is even more rare than carcinoma. Sarcoma is more likely to occur in the form of an isolated tumor mass, and from its vascularity and exposed position hematuria and vaginal pain are early symptoms.

Angiomata of the urethra are exceedingly rare if we exclude from this heading the urethral caruncle which from its rich supply of blood-vessels is sometimes considered as an angioma. Varicosities and angioma formations of the vagina and vulva sometimes extend over into the urethral structures.

Elephantiasis of the urethra is another extremely rare condition and it is usually secondary to a syphilitic or tuberculous process in the vulvar region.

Neuroses of the urethra, like neuroses of the bladder, have been relegated to a progressively narrowing corner *pari passu* with our improved methods of observation and diagnosis. The two conditions are so closely related that they may be discussed under neuroses of the bladder.

DISEASES OF THE BLADDER.

Anatomy.—The urinary bladder normally lies in the true pelvis behind the symphysis pubis. Its size, form, and position vary with its degree of fullness.

¹ Archiv. f. Gynäkologie, lviii, S. 463.

The female bladder is smaller and has thinner walls than the male bladder. It lies deeper in the pelvis, and, corresponding with the greater lateral capacity of the pelvis, and with its relations to the uterus and broad ligaments, it is more elongate in the lateral measures and more flattened in the sagittal measure. In women the internal urethral orifice is about 6 cm. below the conjugate of the superior strait.

In taking measurements of twenty-five normal bladders in living women, seventeen with anesthesia and eight without anesthesia,¹ we found that the average distention with air, the patient being in the knee-breast posture, was 300 c.c., while the average fluid capacity was 430 c.c.

The bladder is supported in the pelvis by the uterovesical ligaments running from the cervicouterine junction forward beneath the bladder to the arch of the pubes, and by the more reticulated fibrous tissues connecting the bladder with its surrounding structures, the symphysis and abdominal wall in front, the lateral pelvic walls on the sides, the uterus, vagina, and broad ligaments behind, and the urachus, obliterated hypogastrics, and peritoneum above and in front.

The musculature consists of interlacing bundles of smooth muscle fibers which have a general disposition to form three layers—an outer and inner longitudinal, and a middle circular layer. The epithelium is of the stratified transitional type, and, together with the loose connective-tissue mucosa beneath, it is extremely distensible. Glands are said to sometimes exist in the immediate neighborhood of the urethra. The serosa is formed by the overlying peritoneum.

The bladder has a rich blood-supply, mainly through three arteries—the superior, middle, and inferior vesicals. The uterine and vaginal arteries supply small twigs. The venous outflow occurs chiefly through the pudendal, vesicovaginal, and vesicouterine plexuses. The least vascular portion of the bladder, and therefore, from this standpoint, the most favorable for operation, is the vertex. While the trigonum and base have the greatest blood-supply, the making of a vesicovaginal fistula rarely causes trouble from hemorrhage. On making an incision through the vertex the immediate hemorrhage seems formidable, but if ignored it soon ceases. I take this to be due to the early retraction of the tortuous bladder vessels and their compression by the bladder musculature.

The lymphatics accompany the blood-vessels and empty into the pelvic glands. Absorption from the normal bladder is exceedingly slow, whereas one cannot be too careful in using cocaine in an ulcerated bladder.

The sympathetic nerves are derived from the hypogastric plexus and the sensory from the anterior branches of the third and fourth sacral

MALFORMATIONS.

The more usual malformations are double bladder, loculate bladder, and exstrophy. Pagenstecher² classifies the double bladders under three types: (1) the

¹ Hunner and Lyon: "Mensuration and Capacity of the Female Bladder," *Jour. Am. Med. Assoc.*, Dec. 16, 1899.

² "Angeborene Blasendivertikel und Doppelblasen," *Archiv f. klin. Chir.*, 1904, lxxiv, S. 186.

hour-glass shaped bladder, from a narrowing in the transverse diameter; (2) the double bladder, tending in men to empty into one urethra, *vasa bipartita*, and in women to be divided entirely through bladder and urethra, *vasa duplex*; (3) the most numerous and the most important type of double bladder, the *vesica bilocularis*. In the congenital bilocular bladder there may be two ureters emptying into one bladder, or four ureters, two of which empty into each division of the bladder; or of two ureters, one may enter each section of the bladder, or one may enter the bladder while the other empties into the vagina.

It is not always easy to decide whether one is dealing with a congenital or an acquired anomaly. Surgeons who see many male cases not infrequently see loculate bladder follow overdistention due to some obstruction, such as that from an enlarged prostate. This leads to hypertrophy of the muscle bundles and thinning and bulging of the spaces between. I have watched the development of the hour-glass bladder in two cases. One was in the case of a girl of fourteen years for whom I performed a vesicovaginal fistula to drain a small, generally ulcerated and contracted bladder. After several months of rest the vesical mucosa became normal in appearance, and I closed the vesicovaginal fistula and urged the patient to hold the urine in order to again distend the bladder. In this process of distention a protrusion of the bladder wall developed in the vertex. The protruding sac was spherical in outline, about 2 cm. in diameter, and communicated with the bladder by a circular opening about 1 cm. in diameter. The rim of this opening looked like scar tissue, and I explain such cases on the grounds that during the ulceration and contracted state of the bladder, portions of the wall normally somewhat remote become agglutinated, and when the walls become more normal and begin to dilate, weakened areas in the lines of agglutination dilate more rapidly than the surrounding walls, forming an accessory pouch. In another case I watched the development of one of these pouches after the removal of a vertex ulcer of large size, suture of the bladder wall, and suprapubic drainage. A bladder may become bilobed by having a portion dragged into an inguinal hernia, here to increase in size. This happens most often in children. With congenital loculate bladder and double bladder one generally finds some other maldevelopment in the sexual or urinary organs.

The chief clinical interest in these cases arises from the associated anomalies of development; and, within themselves, from the liability to decomposition of urine and stone formation in the secondary pockets.

Treatment is not indicated except for the associated pathologic phenomena.

Exstrophy.—Exstrophy or extroversion of the bladder is one of the most deplorable afflictions of mankind, and fortunately it is very rare. In this condition there are various degrees of exposure of the bladder mucosa, due to the failure of the lower abdominal walls to meet during fetal life.

The usual picture is that of a convex, red, mucous membrane tumor situated in the hypogastric region. This bulging mass represents the posterior walls of the bladder, and the ureters are generally found opening freely on the lateral borders of this tumor at about the junction of the mucous membrane and skin. When the

patient takes the recumbent position the exstrophy may recede and even invaginate within the rectus walls. Portions of the exposed mucosa may be ulcerated and bleed easily. From the literature on this subject it would seem that these cases are particularly liable to cancer and other tumors. From one of my cases, a woman of twenty-six, I removed a walnut-sized papilloma.

The associated anomalies of development, one or more of which are always present, can only be mentioned here. The symphysis pubis may have a separation and ligamentous union. There is diastasis of the lower ends of the rectus muscles. If the failure to unite affects the upper portion of the allantois the urachus remains open and the umbilical scar is found relatively low, in other words, at the upper edge of the open bladder. At the lower end of the former allantois one may find epispadias of various degrees, absence of the urethra, and cleft clitoris. In the male non-descent of the testicles is common, and in the female the genital organs may show failure of fusion. At times, however, the internal genital structures are normal and pregnancy has occurred. Not infrequently there is maldevelopment of the sphincter ani and prolapse of the rectal mucosa, as I have noted in a girl of three years.

The leaking urine is indifferently controlled by mechanical devices, and the foul odor of decomposition makes the patient disgusting to himself, tolerated by his compassionate family, and shunned by his companions. The isolation from the companionship of others leads to shyness, suspicion, and mental deficiency.

Treatment.—Until quite recent years this condition has held the surgical world in defiance. During the last half of the nineteenth century much zeal and energy were expended in efforts to cover in the exposed mucosa by plastic methods. A score or more of operations were often done on one patient, leaving at best a small urinary sac, usually without sphincter control; and too often such a sac had to be repeatedly treated for inflammatory conditions and stone formation.

The second method of surgical treatment, and one that may be considered today as a well-established principle, is that of diverting the urinary stream into the rectum, which serves as the urinary bladder.

In 1852 Simon¹ operated on a boy of thirteen years for exstrophy of the bladder by anastomosing the ureter and rectum. He passed blunt needles threaded with silk up into the ureter and thence through the ureteral and intestinal walls, tying the thread tightly on the rectal mucosa. Communication resulted, but urine continued to flow from the ureteral orifices, and the boy died of suppurative nephritis at the end of one year. In 1879 Thomas Smith² grafted the ureters into the colon on a boy of seven for exstrophy. The first operation was on the left side, the lumbar ureter being severed and its proximal end grafted into the descending colon, and the second operation followed in fourteen months, the lumbar ureter of the right side being grafted into the ascending colon. The patient died in fifty hours, and autopsy showed an obstruction at the point of the first anastomosis, with cystic dilatation and

¹ Lancet, London, 1852.

² St. Bartholomew's Hospital Reports, 1879, xv, p. 29.

atrophy of the kidney. Death was due to anuria from obstruction at the site of the last anastomosis.

To Maydl¹ belongs the credit of first transplanting the ureters in a manner which preserves the function of the ureterovesical musculature. He transplanted the entire bladder trigonum to the sigmoid or rectum. In 1896 he reported in the same journal 22 cases with 3 deaths. Katz² collected 76 cases done by the Maydl method or by slight modifications of the same. The mortality was about 33 per cent. Fourteen cases died within five days, 1 from chloroform, 1 from hemorrhage, 6 from peritonitis, and 6 from pyelonephritis. Seven cases died within two weeks, probably from pyelonephritis. Five cases died within the first two and one-half or three years, probably from ascending infection. One of the greatest objections to the Maydl operation is the fact that it is an intraperitoneal maneuver.

Moynihan³ has overcome the dangers attendant on the intraperitoneal method by an operation similar to that of Maydl. First catheterizing the ureters, he excises the entire bladder wall, and after pushing the rectovesical peritoneum upward off the anterior face of the rectum, he incises the rectum, inverts the bladder, and implants it into the rectal wall.

I consider the best operation yet devised for exstrophy of the bladder to be that of George A. Peters, of Toronto. Peters⁴ makes an extraperitoneal transplantation of each ureter into the corresponding side of the rectum, taking with the ureter enough of the bladder wall to preserve the ureterovesical musculature.

After catheterizing the ureters the excision of the button of bladder wall is begun on the lower or pubic side of the ureteral orifice in order to certainly avoid the peritoneum. With a finger in the cellular space thus opened, the remainder of the dissection can be easily guided by the finger and the catheter. On meeting the peritoneum investing the ureter in the upper portion of the wound this can be avoided or gently stripped back. After the roset of bladder is entirely free the ureter is easily dissected from its loose bed, and should be carefully followed back without traction until enough is freed to insure its taking approximately a straight course from the brim of the pelvis to its new location in the lateral wall of the rectum. Peters transplants at a point just above the internal sphincter of the rectum. A forceps is carried through the anus and pressed against the selected spot. A knife makes a slight cut from the outside, and the forceps are forced through and dilated just enough to make an opening that will hold the ureter snugly. After drawing the button of bladder into the rectal opening, the catheter is removed from the ureter, and when both sides are completed a small drainage-tube is left in the rectum. In his first operations Peters left the catheters in the ureters, but after a death from ascending infection he condemns this procedure and even questions the advisability of using a catheter at all.

Excepting his case number four, all of Peters' five cases are living and well, and retain their urine from one to four hours during the day, and from six to eleven hours

¹ Wiener med. Wochenschrift, 1894.

² Thèse de Paris, 1903.

³ Annals of Surgery, 1906, xliii, p. 237.

⁴ British Med. Jour., June 22, 1901.

during the night (personal communication). It is now over seven years since his first operation.

Lendon, of Australia, performed an exactly similar operation (May 22, 1899) two months before Peters' first operation, and another in July, 1901, but his two cases were not published until the past year.¹ In the same issue Newland, of Australia, publishes a case, and in the same journal of May 19, 1906, is the report of a case by Bond, of England.

Sherman,² of San Francisco, reports a successful case done by the Peters' technic, and quotes one done by Pye Smith. This makes ten cases with two deaths, a record that will probably be greatly improved upon, with greater perfection of detail in the operation.

The advantages of the Peters operation are that it preserves the ureterovesical musculature as truly as do the Maydl or Moynihan operations. It is entirely extraperitoneal. Its simplicity and ease of execution result in a minimum trauma, and therefore in greater likelihood of a proper immediate ureteral function. The amount of infection of tissues should be far less than by the Moynihan operation, and therefore the dangers of remote contractures and strictures about the ureters are reduced to a minimum. The Moynihan operation is applicable only in males, and the author recognizes the dangers of injury to the sexual organs.

In case of imperfect sphincter ani and prolapse of the rectum this condition must be corrected before transplanting the ureters. It may be an advantage after these ureterorectal anastomoses to leave a rubber drainage-tube in the anus a few days, but the practice of over-dilation of the sphincter ani for temporary paralysis should be condemned, as one can never be sure that the muscle will recover its sphincter action.

It is possible that future work may demonstrate the advisability of avoiding all interference with the ureters by making a rectovesical anastomosis³ and later bringing the separated pubic bones together (Trendelenburg) and entirely closing in the extroverted bladder. In one case I found that after anastomosing the pubic bones in front the natural position for the extroverted bladder became that of inversion, and the complete closure of the bladder would have been very simple because of the redundant tissues gained by bringing the separated recti together. Unfortunately this patient had reached adult life, and the separation of the sacroiliac synchondroses, which was done by an experienced orthopedic surgeon, was a formidable operation from which the patient died several hours later owing to deep hemorrhage from the bones.

Experience alone could demonstrate whether a bladder thus inclosed, and communicating by a large opening with the rectum, would completely empty itself, or whether retained and infected urine would result in inflammatory conditions and stone formation. Jacob Frank,⁴ of Chicago, has done considerable experimental work on dogs, anastomosing the rectum and bladder with a decalcified bone coupling.

¹ British Med. Jour., April 28, 1906.

² Jour. Am. Med. Assoc., Sept. 23, 1905.

³ Lloyd: Lancet, 1851, ii, p. 370.

⁴ Medical Review, Oct. 14, 1899.

DISPLACEMENTS.

The bladder is subject to physiologic displacement during the later months of pregnancy.

The marked displacement upward due to overdistention may be either physiologic or pathologic, according to its cause and extent. Tumors such as myoma and sarcoma of the pelvic organs and ovarian cysts may, by their position or because of inflammatory adhesions, carry the bladder into unusual positions either upward or downward. Downward displacements are generally associated with descensus of the uterus or prolapse of the anterior vaginal wall, and are called cystocele.

Urethral cystocele is a rare condition in which the bladder enters the urethra, and according to its degree it is called invagination, when the bladder wall merely enters the urethra; inversion, when the wall reaches the external orifice of the urethra; and prolapse, when the bladder protrudes from the urethra. The inversion and prolapse must be diagnosed from urethral caruncle and prolapse of the urethral mucosa.

The bladder may enter the various neighboring canals leading from the pelvis and form true hernia of the bladder. The symptoms and treatment of this condition are discussed in the chapter on hernia in women.

The chief importance of displacement from overdistention arises from the liability of an error in diagnosis; the overdistended bladder having been mistaken for pelvic abscess, pregnancy, and pelvic tumors. The possibility of upward displacement should always be borne in mind when making an abdominal incision for large pelvic tumors.

The downward displacement in the form of cystocele may lead to partial retention, infection, cystitis, and stone formation.

The *treatment* of the various dislocations of the bladder is so intimately dependent upon the treatment of the various allied conditions that it does not need special mention.

FOREIGN BODIES.

The female bladder not infrequently becomes the lodging-place of foreign bodies. Hair-pins, hat-pins, and various objects introduced in the urethra through curiosity or with erotic intent are frequently lost in the bladder. Rubber catheters and other foreign bodies find their way through the urethra in bungling attempts to perform abortion. Fig. 249 represents an incrustated piece of rubber tubing which I removed from the bladder of an unmarried woman when she was six months pregnant. This was said to have been introduced at about the second month of pregnancy by a professional abortionist. In Fig. 250 are shown portions of a glass catheter which



FIG. 249.—RUBBER TUBING LOST IN THE BLADDER IN ATTEMPTED ABORTION.

Dilatation of the urethra at the sixth month of pregnancy and removal of the foreign body.

were broken off in the bladder during the second stage of labor, due to impingement of the fetal head against the symphysis in a strong uterine contraction.¹

Unless the foreign body has a sharp point and is of the proper dimensions to become driven into the bladder wall its presence is usually well borne until infection



FIG. 250.—THE FIVE SMALLER PIECES IN THE LOWER PART OF THE ILLUSTRATION WERE REMOVED BY MEANS OF THE ALLIGATOR FORCEPS THROUGH A NO. 10 SPECULUM TEN DAYS AFTER LABOR.

and cystitis take place. If allowed to remain for any considerable length of time, the foreign body becomes incrustated with urinary salts. Fig. 251 shows a short piece of rubber tubing which was being used for suprapubic drainage and became lost in the bladder for two or three weeks.



FIG. 251.—RUBBER TUBING LOST IN BLADDER.

Showing incrustation with urinary salts in less than three weeks.

The cystoscope is invaluable as a means of diagnosis and removal of foreign bodies. With the aid of the speculum and the alligator forceps (see Figs. 252, 253) any foreign body which has been introduced through the urethra can be removed unless it has become so incrustated with urinary salts as to have greatly increased in size. In case there has been such increase in size as to threaten the urethra with injury it may be removed by the vaginal or suprapubic incision.

Rarely a foreign body is spontaneously passed through the urethra, and, as occasionally happens with stone, it may become wedged in the urethra, causing retention of urine. Sharp-pointed bodies may work through the walls into the vagina. A more unfortunate circumstance is to have them work through the bladder wall into the pelvis or peritoneal cavity, causing abscess formation or peritonitis.

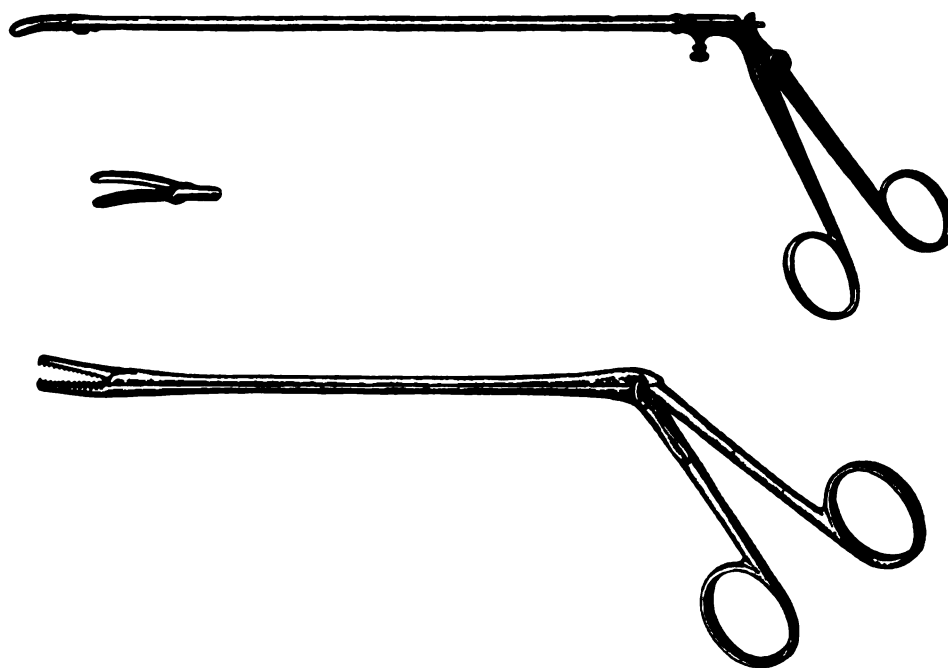
VESICAL CALCULUS.

Stone in the bladder resulting from the passage of a calculus from the kidney or ureter is called primary; or, forming *in situ* about inflammatory products, silk ligatures, or other foreign bodies, it is called secondary. Stone in the bladder is a disease of childhood and old age, rarely developing in middle life.

¹ Hunner: "Dangers in the Use of the Glass Catheter During Parturition," Am. Med., 1904, viii, p. 805.

The **symptoms** of stone in the bladder are those of cystitis, associated with a foreign body; in other words, pain, disturbance of micturition, and pathologic urine. A patient may carry a vesical calculus for years without special disturbance of any kind. The pain when present is usually exaggerated by physical exercise, and it is usually most intense at the end of the act of micturition. Any of these phenomena are likely to be associated with the presence of ulcer in the base of the bladder. There is likewise nothing characteristic about the urinary examination, as one finds pus and blood and even calcareous particles in many cases of cystitis.

The **diagnosis** is made by palpating the stone through the rectum or vagina; or, second, by sounding the stone with some hard instrument, such as a glass or



FIGS. 252 AND 253.—ALLIGATOR FORCEPS WITH JAWS OF DIFFERENT FORM.

For the removal of foreign bodies and for general use in removing portions of the bladder wall for examination, the making of local applications, etc.

metal catheter or metal sound; or, third, by our best means of diagnosis, the use of the cystoscope. Through the cystoscope the number, size, and character of the stones can be ascertained. Bimanual palpation of the stone with one finger in the rectum or vagina is not as certain a method as one would *a priori* suppose. This is often due to the great tenderness in the bladder causing the patient to keep the abdominal muscles rigid, so that one does not gain a real bimanual apposition. In sounding for a stone one must remember that a thin urinary salt deposit over a bladder ulcer gives a sensation very similar to that of stone. If one is palpating with the metal or glass catheter while withdrawing the urine, he should not mistake for stone impact a certain characteristic click of the catheter which I have noticed many

times. Whether it is due to sudden air compressions in the catheter or to the sudden release of mucous membrane which has invaginated over the end of the catheter, or to some other cause, I have not been able to decide. But the sensation is similar to that of stone impact, and I have often purposely misled the students by asking them to work the catheter back and forth and describe what they feel in the bladder.

The **removal of stone** from the female bladder is comparatively simple. The stone may be crushed and its particles aspirated according to the popular method used for stone in the male bladder; but vaginal cystotomy is usually such a simple matter that it is the preferable method in women. In the case of children the suprapubic route is preferable, and it is made comparatively safe by the relatively large prevesical space not covered by peritoneum. The child's bladder should be distended with air or a fluid before making the suprapubic incision. In aged women or in any case where a general anesthetic is contraindicated the vaginal operation is not difficult under local anesthesia.

The question of draining the bladder should usually be determined by the etiology of the stone. If the history shows that the stone has come from the kidney or ureter, or if the stone is found to have formed about a foreign body, it is usually safe to close the bladder after removal of the stone, because a cystitis secondary to the stone will usually heal quickly. On the other hand, if the history indicates that the stone is secondary to a cystitis or if the bladder walls are badly diseased it will be safer to drain the bladder until the mucosa is restored to a healthy condition, when measures can be taken for closure of the fistula.

INFLAMMATIONS.

Cystitis is a term used to include all inflammatory conditions in the bladder.

Etiology and Pathology.—Cystitis in women generally arises and progresses because of a bacterial invasion of the bladder. Many cases have no other cause that we can determine than the invasion by bacteria. On the other hand, many cases, the majority perhaps, have some other definite factor, of which we may speak as the predisposing cause.

Such predisposing causes are inanition and anemia from any cause, particularly from wasting diseases or from old age; displacement of the bladder and interference with its normal blood-supply and with its physiologic functions, as from pregnancy, tumors, and prolapsus of the vesicovaginal septum. Foreign bodies, such as the contents from a dermoid cyst of the ovary, or from a gestation sac, may give rise to conditions favoring bacterial invasion of the bladder; but it is probable that the process that determines the fistula in such cases is usually of an inflammatory character and carries with it the infection. When stone in the bladder is accompanied by infection it may be impossible, from the history of the disease, to determine whether the stone or the infection was the primary process, but the trauma of a stone undoubtedly acts as a predisposing cause of cystitis in an otherwise healthy bladder. Vesical tumor acts as a predisposing cause of cystitis.

Pericystic diseases such as pyosalpinx, ovarian abscess, and parametrial in-

flammation may communicate their infection directly through the bladder walls, but it is probable that when cystitis exists together with these conditions both processes have often arisen at the same time and date from a gonorrheal or puerperal infection. In tuberculosis of the surrounding pelvic organs cystitis represents an extension and is secondary.

Trauma is undoubtedly the most prolific predisposing cause of cystitis in women.

Local congestions from "catching cold" may possibly determine a bacterial invasion, as may the congestion due to very acid urine, but it is questionable whether these conditions alone and without one of the above mentioned predisposing factors can give rise to cystitis.

It is impossible to present an entirely satisfactory classification of the inflammatory processes to which the bladder is subject. We cannot differentiate cystitis wholly from the bacteriologic standpoint, since we not infrequently see cases of cystitis from the urine of which we can isolate no bacterial cause. There is no distinct clinical picture associated with specific organisms. Tuberculosis, when showing the typical tubercles in the mucosa, forms an exception to this rule, but generally the ulcerated tubercular bladder has no distinctive diagnostic picture. Again, we find associated with a tubercular kidney ulcerations in the bladder which quickly heal spontaneously after removing the diseased kidney, thus showing that they are not specific tubercular processes. We have removed such ulcers at the time of the kidney operation and on microscopic examination could find in them no evidence of tuberculosis.

Tuberculosis of the kidney and the associated ulceration of the bladder often have a mixed infection, usually with the colon bacillus, and we cannot say what part this second organism may play in the cystitis. Again, we grow the colon bacillus from a case of cystitis in which the appearances of the external genitalia and the history of the case speak most positively for an original gonorrheal cystitis. Undoubtedly the more hardy intestinal species likewise often replace an original pneumococcus cystitis.

An effort to classify according to anatomic features, and the use of such terms as endocystitis, pericystitis, paracystitis, and interstitial cystitis, is even more futile than the bacteriologic method. Such terms as post-*puerperal* cystitis, post-operative cystitis, and foreign-body cystitis are convenient expressions for conveying an idea of the predisposing factors in an individual case, but they give us no information regarding the specific underlying cause or the conditions present.

Traumatic cystitis is a term which might readily be used to include any of the above terms. The post-*puerperal* cystitis usually follows injury to the bladder or urethra during labor plus the infection implanted during labor or later by catheterization. The post-operative cystitis occurs most frequently after operations which involve injury to the bladder, such as those for carcinoma of the cervix uteri. In such cases there is usually severe injury to the bladder walls, and this is often followed by temporary inability to pass the urine and consequent catheterization. Foreign-

body cystitis arises from trauma plus infection. The trauma may have been active over a long period of time, as in the case of calculus, or it may have been recent and acute, as in one of my cases, where a large-headed pin was lost in the bladder during a urethral manipulation by the patient. I reported one case in which an acute foreign-body cystitis came on in ten days after a glass catheter was broken off in the bladder during the second stage of labor (see Fig. 250).

In this day of cystoscopy our most useful classification depends upon a description of the appearance of the bladder mucosa, and in simple form may be presented as follows.

1. *Hyperemic, Congestive, or Catarrhal Cystitis*.—In the catarrhal form of cystitis the mucous membrane may show only the slightest abnormally pink blush (hyperemic cystitis), or there may be a distinct increase in the number and size of the visible mucosa vessels (congestive cystitis). The congestions of the pregnant state and of the menstrual period must not be mistaken for these forms of cystitis.



FIG. 254.—SHOWING THE ENTIRE BLADDER MUCOSA IN SUPPURATIVE EXFOLIATIVE CYSTITIS.

the condition is sometimes spoken of as suppurative cystitis, and when there is a deposit of cellular or fibrinous debris and urinary salts the condition has been called exudative cystitis.

3. *Exfoliative Cystitis*.—This term is used to describe the rare form of cystitis in which there is an *en masse* shedding of the mucosa over areas of greater or less extent, leaving raw surfaces of exposed muscle. Fig. 254 shows the extreme grade of this condition, in which the entire bladder mucosa, together with considerable of the underlying muscle tissue, came away in one piece. The patient, a primipara, twenty-eight years of age, had a forceps delivery eighteen days previous to my first visit. She was found to have a bladder tumor reaching to the umbilicus and a necrosing, stringy mass protruding from the urethra. She had suffered considerable pain for twenty-four hours with almost constant strangury. The patient

2. *Ulcerative Cystitis*.—In this form there is an actual loss of the mucosa epithelium, as seen by an excavation in the mucosa, or by an area of granulation tissue which bleeds spontaneously or on the slightest touch and in which the blood-vessels can no longer be individualized. The granulation tissues may present projecting formations, such as ridges and papules, especially in the healing stage of an ulcer.

When mucus and pus cling about the ulcerated surface

was sent to the hospital and a vesicovaginal fistula was made at once, letting out the above mass and two or three liters of purulent, streptococcus urine. She was immersed in a tub on the third day and copious bladder irrigations with silver nitrate solution, alternating with boric acid solution, were used daily. On the sixteenth day I examined the patient in the Sims position and found an area of white epithelium around the vesicovaginal fistula opening, the remainder of the bladder showing a red granulating surface which bled easily on the slightest touch. At the end of ten weeks the epithelium had covered the entire bladder except for a small circle in the vertex. A few silver nitrate applications were followed by complete healing of this area.

Boldt¹ has considered the subject of exfoliative cystitis in a comprehensive manner.

Certain rare forms of cystitis have been described which deserve special mention, but which might possibly be classified as phases of either the catarrhal or the ulcerative forms of cystitis.

4. *Vesicular Cystitis*.—Not infrequently in mild catarrhal cases we see a few glistening, bead-like vesicles the size of a pin's head. In certain rare cases there are innumerable vesicular swellings, and on close inspection we find that these are arranged in bead-like strings on either side of the blood-vessels. They are undoubtedly dilated lymphatics, and at times we find a direct cause for lymph stasis, such as pelvic inflammatory disease, or neoplasms interfering with the trigonum or base of the bladder. I have also seen the condition associated with tuberculosis of the surrounding pelvic peritoneum in which there was no visible tubercular lesion of the bladder, in a case of varicocele of the bladder, and in a case where panhysterectomy had been performed.

Instead of the small vesicles the mucosa may be occupied by large blebs, and according to the extent of the lymphatic swelling this condition has been variously named "vesiculation of the bladder" (Fenwick), "*bulloes oedem*" (Köllischer), and similarly by Kreps² "*adema bullosum vesicæ urinariæ*." I have known the small vesicles to be mistaken for the isolated tubercles of tuberculosis, but a close inspection shows their shiny, translucent, or opalescent character, and they usually lack the red inflammatory circle which forms a base for the opaque tubercle. While the tubercles may be arranged in rows, I have never seen long strings of them, as with the vesicles, and in certain areas one finds them arranged in groups quite independent of the visible vascular distribution.

5. *Leukoplakia Cystitis*.—Kreps (*loc. cit.*) describes a case of *leukoplakia vesicæ* in which the mucous membrane of the bladder showed a patch of yellowish thickening similar to the leukoplakia buccalis of the luetic or of the excessive smoker. In 1888 Antal described the condition as *xerosis vesicæ*. Dittel in 1895 saw what he supposed was a scar in the bladder, but which he found at autopsy to be a patch of epithelial cells, horny in character and arranged in many layers.

¹ Am. Jour. Obstet., 1888, xxi, p. 350.

² Centralblatt f. die Krankheiten des Harn- und Sexualorgane, 1902, Bd. xiii, S. 627.

6. *Malakoplakia Cystitis*.—*Malakoplakia vesicæ urinariæ* (from the Greek *μαλακος*, "soft") is the name given by v. Hansemann¹ to a peculiar bladder affection for which there seems as yet to be no definite pathologic classification.

Gierke² collected seven cases from the literature and added two from the Pathologic Institute of Freiburg. From these nine cases it appears that this form of cystitis is characterized by soft nodules or plaques of a yellowish or yellowish-gray color situated in the mucous membrane and submucosa of the bladder, not unlike the Peyer's patches of a typhoid intestine. These plaques vary in number, there having been about a hundred in one case; they are round or oval, isolated or conglomerate, vary in size from 1 mm. to 2 cm., and apparently have no characteristic disposition in the bladder. In two of the cases the plaques were found in the ureter and pelvis of the kidney. The mucosa of the immediate vicinity is congested, but the remainder of the mucosa may or may not show evidences of inflammation. The mucosa and epithelium over the nodules is usually thinned, at times presenting but one layer of cells, and in the larger nodules there is sometimes absence of epithelium with ulceration over the center. Microscopically the nodule consists of a great accumulation of large cells of the phagocytic type interspersed with but few capillaries and connective-tissue cells.

The etiology is obscure. Unfortunately no case has been discovered and studied during life. Of the nine cases reported, four had tuberculosis in the system. In several of the cases there have been observed short rod bacilli corresponding morphologically and tinctorially with the typhoid-colon group. These are usually found in clumps and within the phagocytic cells. Mallory³ mentions one of these cases, and George H. Whipple will soon report a case from the Pathological Department of the Johns Hopkins Hospital. The microscopic sections from both Mallory's and Whipple's cases show the collections of short rod bacilli.

In describing a case of cystitis as above classified on the mucous membrane appearances one makes many additions to complete the picture. For instance, the case is acute or chronic according to the duration. The lesion is local, diffuse, or general, and according to locality it is trigonal, basal, fundal, or in the vertex, or it is on the anterior, posterior, or lateral walls. If an ulcer, it is superficial or deep, round, linear, or irregular in outline. Bacteriologically speaking, it may be of tubercular, gonorrheal, colon bacillus, typhoid, or other origin, but from what was said above we see that these terms should be used advisedly.

Symptoms and Diagnosis.—With the present-day methods of investigation no case of cystitis should be overlooked. We depend for a diagnosis upon the patient's history, the examination of the urine, palpation, and cystoscopy.

The chief symptoms in cystitis are burning and frequent micturition, strangury (reserving this term to mean difficult and painful micturition accompanied by urgency, straining, and vain efforts to urinate), and pain, using this term to cover

¹ Virchow's Archiv, 1903, Bd. clxxiii, S. 302.

² Münchener med. Wochenschrift, 1905, Bd. lii, S. 1388.

³ "Proliferation and Phagocytosis," Jour. Exp. Med., 1900, v, p. 1.

the more intense degrees of discomfort, whether spontaneous or arising from the activities of the bladder.

We can sometimes, but not always, gain an idea of the character and location of the cystitis from the patient's history. In a nervous woman a mild grade of catarrhal inflammation may give rise to profound complaint, whereas in the more stoical the same grade of trouble would call forth a mild complaint of a burning feeling in the bladder and too frequent urination.

Ulcerative cystitis varies in its symptomatology according to the location of the ulcer, its character, and the nervous organization of the patient. An ulcer in the vertex of the bladder may cause pain only when the bladder is full and placing the ulcer on a stretch or when the bladder is only partially filled and the patient lies on her side, thus bathing the ulcer in the urine. An ulcer about the base is likely to cause more or less constant pain because of the irritation by the urine. Basal ulcers are likely to have a greater nerve-supply and to give pain from urine contact, from stretching of the bladder, or even from movement or jarring of the body. Ulcer at the trigonum is characterized by excruciating pain at the end of micturition, followed by muscle spasm and the passage of a greater or less quantity of pure blood after the urine is voided.

Dogmatic rules cannot be promulgated, however, as one sometimes observes excruciating pain and severe hemorrhage associated with vertex ulcer, while ulcer of the trigonum may cause but little pain and no macroscopic bleeding. I have seen a small fissure at the internal orifice of the urethra cause the typical symptoms of trigonal ulcer together with severe hemorrhage.

The strangury and pain, and the fear of being unable to answer the urgent demand while away from home, all tend to make a recluse of a cystitis victim, and from a nervous state the tendency is toward melancholia and a complete mental collapse. The loss of sleep at night and the enforced reversion to drugs are potent factors in making of the cystitis patient a physical and mental wreck.

Examination of the Urine.—The diagnosis of cystitis is not made unless pus be found in the urine. An exception to this rule obtains in the one class of cases which we classify as trigonitis.

It seems trite to state that a diagnosis of cystitis should not rest upon the finding of pus in the urine unless the specimen is one catheterized from the bladder, so as to exclude the urethra and genital organs as the source of the pus. Even with a catheterized specimen one must bear in mind that the pus may come from the ureter or kidney.

A large amount of albumin in the urine favors the diagnosis of kidney disease, as does the finding of casts. Intermittent variations in the amount of pus favor renal origin. Blood may or may not be present. The former idea of distinguishing bladder from kidney lesion on the basis of clotted or diffuse blood in the urine is now given up, and the cystoscope enables us to accurately determine the source of the blood. The condition of the blood probably depends chiefly on its rapidity of loss, whether from the kidney or bladder.

Another error of the past now fully exploded concerns the reaction of the urine. We know that most cases, of both nephritis and cystitis, are accompanied with acid urine. Former observations were probably often made on urine which had been allowed to stand until decomposition had begun. On finding an alkaline urine we now suspect the presence of one of the alkaline-producing bacteria, such as the proteus. A few cases of cystitis, such as those due to cystocele or complete prolapsus of the pelvic organs, have a constant residual urine showing decomposition products and giving an alkaline reaction. Many of these cases, however, with an odor of decomposition show an acid reaction when freshly catheterized, and yield a colon bacillus culture.

One of the most fruitful factors in our present-day knowledge of cystitis has been the bacteriologic study of the urine. The only positive test of tuberculosis of the urinary tract is the demonstration of tubercle bacilli in the urine either by microscopic examination or by the inoculation of a susceptible animal, preferably the guinea-pig. The most important fact to remember in finding evidences of cystitis and tubercle bacilli in the urine is that tuberculosis of the bladder unassociated with kidney tuberculosis is extremely rare.

The demonstration of tubercle bacilli in the urine has been generally conceded to be a well-nigh impossible task, and various methods have been devised to make the search more certain. It is recommended to dilute the urine with a fluid of less specific gravity, such as alcohol, or to raise the specific gravity by the addition of salt in order to make the bacilli centrifugalize more certainly. Again, it is recommended to cover the glass slide with egg-albumen to make the specimen adhere more firmly.

I have not found these extra precautions necessary, and I consider the demonstration of tubercle bacilli in the urine of comparative certainty. Casper¹ says they are found in 80 per cent. of cases. In my report of 35 cases of urinary-system tuberculosis² there is a record of examination of the urine of 22 cases with positive result in 15, or 70 per cent. Since that time I am certain that my examinations in all tuberculous cases occurring in Kelly's and my own practice have shown more than 80 per cent. of positive findings.

I allow a catheterized specimen of urine to stand a few hours in a conical glass, pipet 5 to 10 c.c. from the bottom, and centrifugalize. The heavy deposit is spread on two glass slides (which have been thoroughly cleansed of grease by alcohol) and allowed to dry in the air or in an incubator. These slides, after fixing by heat, are stained in the usual manner with carbol-fuchsin. I steam them above a Bunsen burner for from three to four minutes, allowing them to heat slowly at first. Decolorize with a 3 per cent. nitric or hydrochloric acid alcohol solution, and counterstain with methylene-blue. Tubercle bacilli are usually found in less than ten minutes' search, but I do not consider a specimen negative until at least a half hour has been devoted to the slide. Diagnostic disputes between excellent clinicians and serious errors occasionally arise because of the intermittent character of tubercular bacteri-

¹ "Genito-urinary Diseases," Phila., 1906.

² "Surgery of Urinary Tuberculosis in Women," American Medicine, 1904, vii, p. 701.

uria in those cases in which there is repeated temporary sequestration of the kidney focus or temporary blocking of the ureter.

The bacilli are often found singly, but their characteristic arrangement is in groups of from three or four up to large masses in which there may be, on a mere estimate, a hundred or more bacilli. These masses are often so large that they are easily found with the low objective.

Smegma bacilli are not likely to occur in a specimen of urine catheterized from the female bladder, but when present they are distinguished by their plumper form, greater absorption of the blue stain, and lack of the grouped arrangement.

A negative culture attempt on ordinary media, in the presence of symptoms and signs of cystitis, is suggestive of gonorrhea or of tuberculosis, but one must not forget that either of these infections may be accompanied by a secondary infection, most frequently by the colon bacillus.

Those who treat acute gonorrheal urethritis in the female should take cultures on special media until we have learned more about gonorrheal cystitis. I believe this condition is much more frequent in the female than is generally supposed. It is impossible from the symptoms alone to differentiate between an acute gonorrheal urethritis and urethritis associated with cystitis. A careful urinary investigation using the four-glass test, centrifugalizing and staining, and particularly the taking of cultures on fresh hydrocele agar, will demonstrate many cases of acute cystitis that with our present methods are undiagnosed and go on to a spontaneous healing. Although a stand has been taken in this chapter against meddling treatment in the acute cases, I believe we are justified in these investigations, particularly as there is no possibility of setting up permanent injury such as would occur with similar investigations in the male. Most gonorrheal cases come to the cystoscopist only in the late stages, and because of the chronic symptoms of trigonitis and urethritis which persist many months after the cystitis disappears and the urine becomes normal. In many of these cases there are distinct evidences over the bladder mucosa of a past severe cystitis.

The various recent workers in the bacteriology of cystitis have arrived at comparatively uniform conclusions, and my own results obtained at the Johns Hopkins Hospital in 1899-1900 may be taken as a fairly representative study. I made plate cultures in agar-agar ninety-eight times in the study of forty women complaining of cystitis symptoms.

In 12 cases the cultures were sterile; tubercle bacilli found in one of these.

In 12 cases colon bacillus was grown in pure culture; tubercle bacilli found in 4 of these.

In 4 cases staphylococcus pyogenes albus was grown in pure culture.

In 2 cases staphylococcus pyogenes albus (non-liquefying) was grown in pure culture.

In 1 case staphylococcus pyogenes aureus was grown in pure culture.

In 2 cases streptococcus was grown in pure culture.

In 2 cases bacillus ureæ was grown in pure culture.

In 2 cases saccharomyces was grown in pure culture.

In 3 cases the culture showed mixed infection:

1 colon and staphylococcus pyogenes albus (non-liquefying).

1 colon and staphylococcus pyogenes albus.

1 unidentified organism.

This list agrees with those of other investigators in that the colon bacillus and the more common pyogenic cocci are found to be by far the most frequent bacterial causes of cystitis.

Palpation.—Under the section on history taking and examination are mentioned the valuable diagnostic features of palpation. One must bear in mind, however, that a patient may have the typical symptoms of cystitis and palpation may discover thickening and tenderness about the bladder, and yet the urine examination and cystoscopy reveal no evidences of cystitis. Such cases often depend upon puerperal or tubercular infection of the pericystic tissues.

Fever.—In the acute stages of cystitis there is often a rise of temperature from 1° to 3° F., but fever is seldom seen in chronic cystitis unless there exists concomitant kidney infection. It is remarkable that a patient with double kidney involvement by tuberculosis, together with bladder infection, may be placed on a four-hour temperature record for weeks and show only the slightest variations.

Tuberculin.—The use of tuberculin for the diagnosis of a bladder lesion is of relative value only, as a reaction may be due to tuberculosis elsewhere. The existence of a bladder ulcer in a person who has tuberculosis elsewhere is suggestive, particularly if there seems to be no other definite cause for the cystitis.

Cystoscopy.—In cystoscopy we have the final and most conclusive test of a cystitis. Disease of the kidney alone, and particularly of the kidney and ureter, may cause the classic signs and the symptoms of cystitis—strangury, pain, and pus in the urine. These same conditions may be due to urethritis alone. If the cystoscope reveals a normal bladder we can easily determine whether the urethra is diseased, and by aid of the renal catheter whether one or both kidneys are involved.

In kidney disease there are often changes about the ureteral orifices which mean a great deal to the cystoscopist, but I cannot go so far as to agree with those who essay to diagnose the different forms of renal or ureteral affections by the cystoscopic appearances of the ureteral orifices. The presence of individual tubercles may be diagnostic, but one must not confuse vesicles with tubercles. Again, a bleb or bulla may be difficult to differentiate from a small polyp, and I have seen the latter about the ureteral orifice of tubercular as well as stone cases. The presence of these signs usually means inflammation in the kidney or ureter above, and the diagnostician will do well to stop here until tubercle bacilli are found in the urine or until the presence or absence of stone is determined by the use of the wax-tipped bougie or the X-ray.

Early in this chapter, under the section on cystoscopy, were mentioned certain conditions in which it is advisable to refrain from using the cystoscope, but for the

great majority of cystitis cases as they present themselves to the physician the cystoscope has proved itself invaluable. By its use we not only determine whether a patient has cystitis, but, as seen above, we learn so much about the character of the cystitis that we find that our most valuable classification of bladder diseases is dependent upon their cystoscopic appearances. By means of the cystoscope we determine whether the treatment should be general or local, and we can easily watch the progress of the disease while under treatment. Foreign bodies are discovered and can often be removed by the aid of the cystoscope. In tuberculosis of the urinary tract it is often well-nigh impossible to determine whether the symptoms of cystitis are due to bladder lesions or to the disease of the kidney and ureter. The cystoscope is our greatest help in settling these questions.

Treatment.—The treatment of cystitis has become one of the most interesting problems in therapeutics. In contrast with the haphazard and empiric methods of the past we now bring to bear accurate methods of diagnosis, and by first determining the etiology, character, and extent of a cystitis we are equipped to begin its treatment in a rational manner.

One of the most striking advances is the ease with which, in spite of predominant bladder symptoms, we can show the cause of many cases to be located in the kidney, and thus prevent useless bladder treatment. An elderly woman recently referred to me for diagnosis had been treated repeatedly during the past twenty-three years for severe cystitis symptoms. She had a prolapsed, enlarged, tender left kidney, the urine was thick and ropy and strongly alkaline, and cystoscopy showed an absence of serious mucous membrane changes in the bladder. Because of her age and nervousness the use of the wax-tipped bougie was omitted, but the X-ray showed an enormous stone in the left kidney, the stone at operation proving to be of unusual size.

In dealing with inflammatory conditions of the bladder we make use of prophylaxis, internal and local medication, and operative measures.

To prevent renal and cystic complications during pregnancy and the puerperium, abundant ingestion of fluids is urged. The same measures should be adopted before and after an operation. If for any reason abundant fluids cannot be taken by mouth, the deficit should be supplied by enemata or by hypodermoclysis. Means should be taken to avoid catheterization during the puerperium and after operations. A hot irrigation over the perineum or a small hot rectal enema will often assist the patient to void for the first time. Baisch¹ recommends the injection into the bladder of a small quantity of some stimulating or hygroscopic disinfectant, such as a 2 per cent. boroglycerid solution. This he finds will supply the needed stimulus to the inert bladder muscle. I have found this method no more certain than the hot rectal enema.

If catheterization becomes necessary after a perineal injury from childbirth or from operation, special precautions must be taken in cleansing the urethra. To the light sponging with small cotton pledgets soaked in sterile fluids should be added a

¹ "Erfolge in der prophylaktischen Bekämpfung der post-operativen Cystitis," *Cent. f. Gyn.*, 1904, Bd. lxxviii, S. 933.

careful irrigation of the external third of the urethral canal just before the catheter is inserted.

After a cystitis is established one of the first measures is to discover and remove its cause. Brown¹ has emphasized the importance of recognizing and treating anemia as a cause of cystitis. Abnormal acidity or alkalinity of the urine should be combated by diluent drinks and the use of benzoic or boracic acid, if the urine be strongly alkaline, or of the alkalies, if the urine be strongly acid.

If the cystitis depends upon disease of the kidney or of the organs surrounding the bladder, the treatment should be directed toward the original disease. Foreign bodies must be removed from the bladder.

Since we recognize microorganisms as an original and continued cause of cystitis, effort must be directed against the infecting agent. It is probable that the ingestion of large quantities of fluid acts on the bacteria in a detrimental manner by reducing the relative amount of the nutrient organic materials in the urine. The above mentioned use of alkalies and acids should likewise make the urine a less desirable medium for the propagation of bacteria.

Of the many drugs used internally for their disinfecting properties I shall mention only a few which have found most favor. Urotropin or cystogen, or chemically hexamethylene-tetramin, used three times a day in 5- to 15-grain doses, is undoubtedly the most effective urinary antiseptic. Formalin is liberated in the urine, and this inhibits or destroys the bacteria of many infections. It is surprising to place two patients with a colon bacillus infection of the bladder on treatment by cystogen alone and to find that in one case the bacteria quickly disappear (in one week in some of my cases), and in the other case the cystogen seems to have no effect. This same phenomenon has been noted by others in using the drug in typhoid fever bacteriuria. I have found the same uncertainty of action in staphylococcus infections.

Salol, by its elimination as carbolic and salicylic acid, sometimes exerts a beneficial effect as a urinary antiseptic. It should not be pushed to the point of causing lumbar heaviness.

Antiseptics used locally as irrigations, instillations, and topical applications, are of the greatest value. Irrigations act not only by inhibiting bacterial growth, but they cleanse the bladder of its inflammatory debris, and act directly on the tissues to soothe or to cause temporary inflammation, which is followed by exfoliation of the epithelium, better circulatory conditions, and healing.

The character and strength of the solution must naturally be gaged to suit the conditions present. A very acute and painful cystitis may not tolerate anything stronger than a normal salt solution carefully given at the proper temperature. Thompson's fluid (borax, 1; glycerin, 2; water, 2) in the proportion of 1 to 8 of warm water is a grateful irrigation in some extremely sensitive cases. The half saturated boracic acid solution is useful as a mild irrigation.

Of the more active antiseptics many are recommended, such as carbolic acid, lactic acid, ichthyol, lysol, potassium permanganate, silver nitrate, and bichlorid

¹ "The Bacteriology of Cystitis," The Johns Hopkins Hospital Reports, vol. x.

of mercury. Of these as bladder irrigations I have had most experience with the last two remedies. For all catarrhal forms of cystitis and for the ulcerative form due to gonorrhea, irrigations with silver nitrate solution in strengths of from 1:5000 to 1:500 have given the best results. One gauges the strength of the solution by its effect on the patient. It may be used in a strength that causes increased burning for an hour or two after the irrigation, but the after-effect should be one of increased comfort. The stronger solutions should not be used more often than every other day and may be alternated with Thompson's fluid or boracic acid solutions. In cases of unusually obstinate cystitis the best results are at times obtained by using such strong solutions that the patient has discomfort for several hours after the irrigation. When following this plan the frequency of treatment should be reduced to every third to fifth day, using the bland irrigation on the intervening days.

Bichlorid of mercury irrigations are used in strengths of from 1:150,000 to 1:5000, and the same rules should apply as to the strength used. In using any irrigation the bladder should be distended sufficiently to allow the fluid to bathe every portion of the mucosa, but the distention should stop short of the point of causing actual pain. An exception to this rule is made in the cases of chronic induration of the bladder walls with small contracted bladder in which hydrostatic pressure is used to restore the bladder capacity. Young¹ is still using this method of overdistention with excellent results.

Instillation of small quantities of the solution to be used is sometimes a useful method. One can use stronger solutions than by irrigation, which makes the method preferable when for any reason the patient cannot be treated more often than once or twice a week. The method is also prefer-

able when one wishes to avoid distention of the bladder walls. The patient receives from one half to two ounces of the medium used (Fig. 255) and is instructed to retain this as long as possible. In extremely painful cases preliminary morphin is given or a weak cocain solution (1 per cent.) is injected

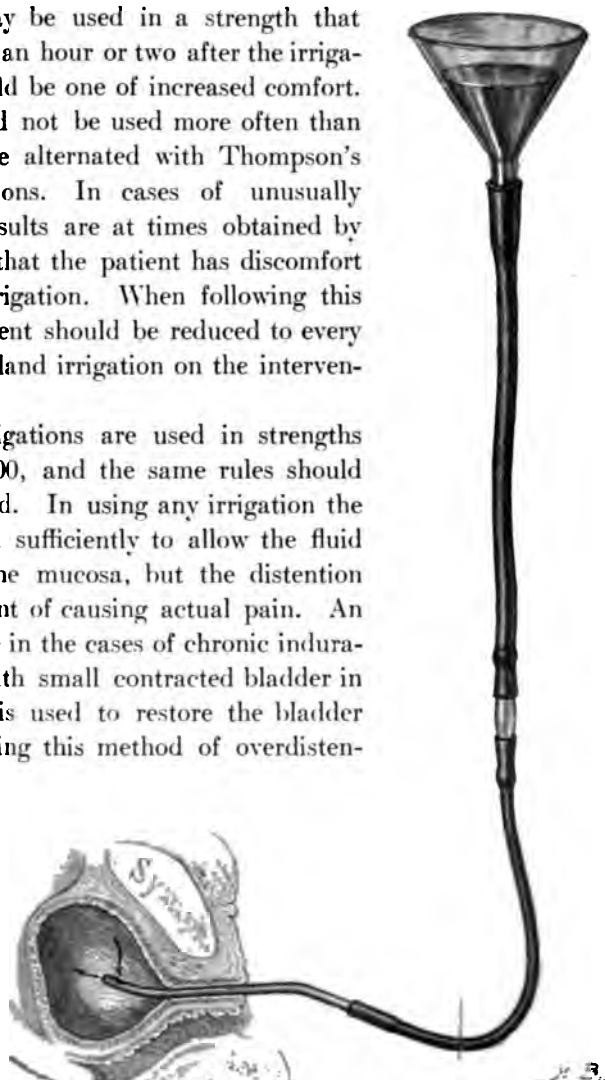


FIG. 255.—SHOWING METHOD OF GIVING BLADDER INSTILLATION.
Both arrows should be pointing away from the catheter.

¹ Johns Hopkins Hosp. Bull., 1898, ix, p. 100.

into the bladder. We have had good results by the use of instillations of protargol, 1 to 3 per cent., in cases of subacute ulcerative cystitis, of nitrate of silver as strong as 1 per cent. in chronic ulcer, and of bichlorid of mercury in strong solutions for tuberculous cystitis.

Guyon first called attention to the fact that silver nitrate does harm rather

than good in tubercular cystitis, and he first advocated the instillations of strong bichlorid solutions. Casper¹ has been an enthusiastic supporter of this method. We have used the method for the past six years and can say that it is the only remedy which has given satisfactory results in the local drug treatment of bladder tuberculosis.

Casper² recommends the use of a small instillation of strong bichlorid, 1:10,000 to 1:1000, and as the symptoms abate he uses a weaker solution in greater quantity, using finally 50 c.c. for each instillation. I have always used from 15 c.c. to 30 c.c., beginning with a solution of 1:20,000, and if this is well borne the strength is rapidly increased. I have never been able to use the bichlorid in a solution stronger than 1:5000, and



FIG. 256.—ARTIFICIAL VESICOVAGINAL FISTULA FOR BLADDER DRAINAGE. Both Figs. 256 and 257 should represent the fistula as made somewhat farther anterior to the cervix.

in one case I was forced to use for some weeks a solution of 1:40,000. The treatments are given once or twice a week. As Casper says, the first improvement is seen in the lessened pain, the frequency persisting for a longer period. The patient

¹ Casper: "Zur Pathologie und Therapie der Blasentuberculose," Monatsb. für Urologie, 1900, v, S. 499.

² "Genito-Urinary Diseases," 1903, Phila.

must be warned that the first effect of the treatment will be an increase in the pain, and Casper recommends the preliminary use of morphin.

The topical application is one of our best weapons in the treatment of localized cystitis. This is used to best advantage through the tubular speculum, the patient being in the knee breast posture and the bladder being freed of urine and distended with air. The great advantage of this method lies in the possibility of treating only the diseased mucosa, for the operator can confine the application to the diseased areas only. It is for this same reason that far stronger applications can be used than by any other method.

For ulcers of the bladder we generally use nitrate of silver, beginning in the ordinary case with an application of a 10 or 20 per cent. solution and reducing the strength as the ulcer heals until a 3 per cent. solution is being used. For the worst cases a stronger application may be used, even the silver stick being applied. When these stronger solutions are used the treatments should be from two to three weeks apart to allow for sloughing and new formation of tissue. One can use the solutions as strong as 5 per cent. twice a week. Pure carbolic acid sometimes gives better results than the silver.

In some cases I have carried ulcers to a certain point of improvement by the silver or carbolic treatment, and have then been unable to see further progress until I resorted to the actual cautery, when the ulcer would rapidly heal. One can be even more accurate in confining the application of the cautery than in the use of the medicated swab.

Surgical Measures.—The treatment by cautery just mentioned should perhaps be classed as a surgical measure. Caution must be used as regards the extent of the cauterization, for a deep slough may give rise to a severe hemorrhage several days after the treatment.

Curetage of the bladder mucosa is a surgical method much used, and one which is by no means as harmless as generally supposed. I have seen cases of acute ascending renal infection follow the use of the curet, and for this reason I condemn its use in that portion of the bladder where the trauma would give rise to inflammatory swelling about the ureteral orifices.

The making of a vesicovaginal fistula, thereby placing the bladder at physiologic rest, is perhaps the most useful surgical procedure we possess for the treatment of intractable cystitis cases. For the same reason that curetage of the trigonum should be avoided, as little trauma as possible should be caused in making a vesicovaginal fistula. This is best done with the patient in the knee-chest or the Sims posture, having the bladder distended with air (see Figs. 256 and 257). The incision should be made at some distance anterior to the cervix, using a very sharp knife-blade which is attached by an obtuse angle to a long handle. The incision is made at some distance from the cervix because of the greater difficulties of closing a vesicovaginal fistula situated immediately anterior to the cervix. The knife-blade should be particularly sharp so that it will plunge smoothly through both the vaginal and bladder walls. With a dull knife one sometimes

cuts through the vaginal wall and pushes the soft pliable bladder wall ahead of the knife, and the air-pressure with the patient in the knee-chest position may immediately cause an awkward separation of the bladder from the vaginal wall. The incision should be made under the direction of vision, as is easily accomplished by introducing a speculum in the bladder and withdrawing it to the internal urethral orifice. The speculum in this position also serves to protect the internal sphincter muscle from too great an extension of the incision. One whipped catgut suture on either side

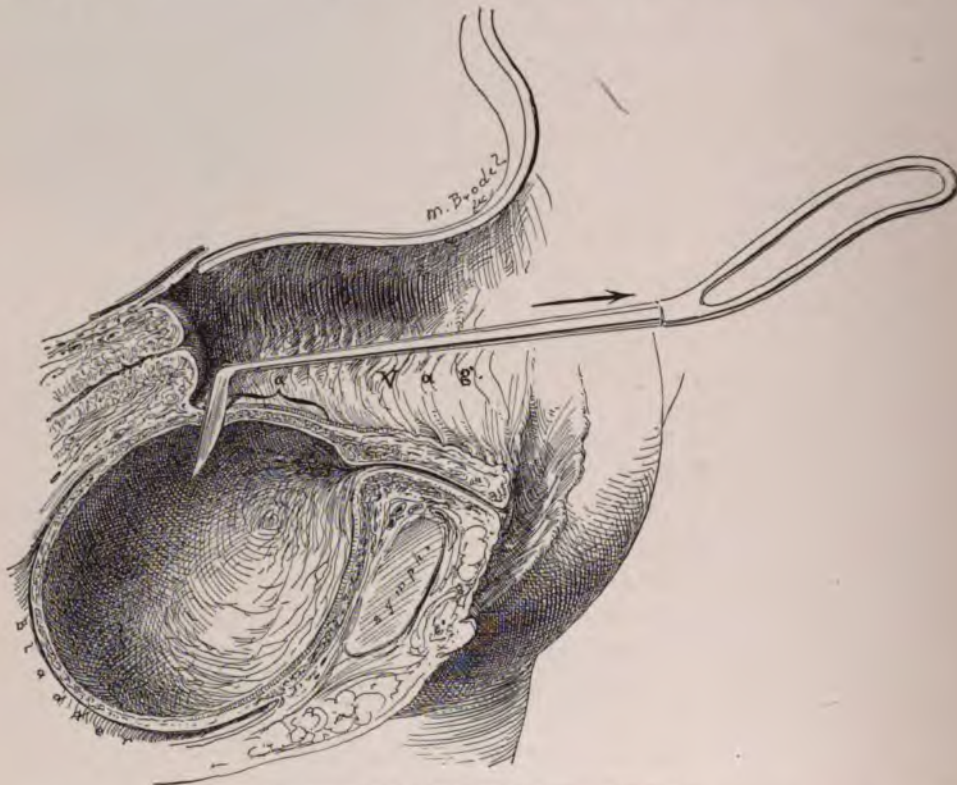


FIG. 257.—THE PATIENT IN KNEE-CHEST POSTURE.

The posterior wall of the vagina is lifted up, a cystoscope is introduced letting air into the bladder and giving visual control of the trigonal area. The bladder is then opened by plunging the knife through the vesicovaginal septum and drawing it toward the internal urethral orifice in the direction of the arrow and over the line included in the bracket "a."

of the freshly made fistula prevents any tendency to serious hemorrhage, and tends to keep the fistula open until it is lined with epithelium.

Most catarrhal and ulcerative conditions of the bladder, not tubercular, heal very readily when placed at rest by means of the vesicovaginal fistula. We can hasten the healing, however, by means of local applications and irrigations as before described. The great objection to a vesicovaginal fistula is the obnoxious condition in which the patient is placed by having the constant loss of urine. Even in hospital practice it is difficult to keep a patient clean and comfortable

while having treatment by this means. It was to keep the patient clean and comfortable, and to more easily make use of a constant bladder irrigation, that I first instituted the use of the tub-bath treatment of cystitis. The patient is placed in a large tub similar to that used for giving typhoid baths (see Fig. 258). By means of transverse canvas strips she is suspended at any distance from the bottom of the tub, and the lower trunk and legs are immersed in water or kept dry, according to the conditions present. If the constant leakage of urine causes soreness or eczema of the perineal region, it is best to keep the patient immersed; whereas she may be kept above the water on the canvas strips if the irrigations suffice to keep the local parts free from inflammation. In cases suffering with



FIG. 258.—PATIENT IN TUB-BATH WITH CONSTANT BLADDER IRRIGATION.

severe cystalgia the water may be kept somewhat above the body-temperature, thereby serving as a grateful sitz-bath.

As the most radical surgical measure, the diseased area of the bladder may be excised. An area that resists the simpler forms of treatment and calls for excision is nearly always of deep extent, and one should therefore remove not only the mucosa but the underlying muscular layers, and if the process is tubercular, even the serosa. Ulcers may be removed through a vesicovaginal fistula, but one cannot easily control the depth of the incision when working by this route. It may therefore be stated as a rule that all excisions should be done by the suprapubic route. Unless the disease is very deep and involves the serosa, one can make all excisions extraperitoneal. There is scarcely any limit to the extent of bladder wall which

may be removed and still insure to the patient an organ capable of practical functioning power.

It is for intractable tubercular indurations that one most often resorts to excision, and it is fortunate that in these cases the healthy side of the bladder generally corresponds to the side of the healthy kidney.

In extensive resections of the bladder wall, particularly those involving the peritoneum, it is often advisable to secure perfect drainage by making a vesicovaginal fistula. This can readily be closed at any time after healing of the suprapubic wound and recovery of the remainder of the bladder.

In the closure of simple vesicovaginal fistula it has been my practice for the

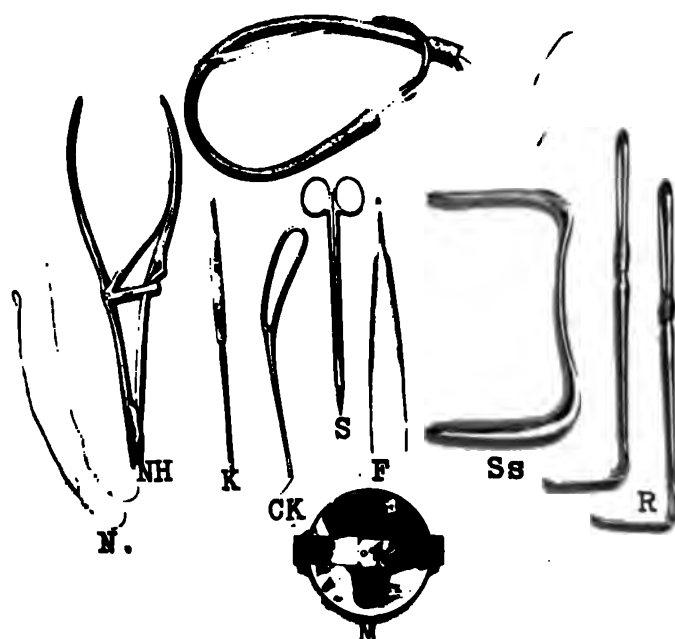


FIG. 259.— COMPLETE OUTFIT FOR THE MAKING OR CLOSING OF A SIMPLE VESICOVAGINAL FISTULA.

past four years to use no anesthesia beyond that induced by the use of an eighth or a quarter grain of morphin hypodermatically. The patient being made comfortable in the Sims position, the fistulous tract is excised and the freshened walls apposed by interrupted sutures of very fine silver wire which penetrate both the vaginal and bladder mucosa. The sutures are tied and the patient is sent from the operating room in a wheel-chair and allowed to walk about from the first. The sutures are removed on the tenth day. Fig. 259 shows the complete outfit (except for the suture materials) necessary for the making or closing of a vesicovaginal fistula.

TUMORS OF THE BLADDER.

Tumors of the bladder are rare, particularly if we consider only primary growths. The connective-tissue tumors, fibroma, myoma, and lipoma, are exceedingly rare. They may reach a size that entirely fills the bladder.

The most common benign tumor of the bladder is *papilloma*, also designated villus polypus and papillary fibroma. This occurs as a sessile or pedunculate, single or multiple tumor, arising from the submucosa layer. It is composed of a fibrous tissue stroma penetrated by a rich blood-supply and covered by several layers of epithelium. The growth is characterized by its multiple tree-like branchings, the ultimate branches or villi being distinguished macroscopically only when floating in a fluid medium.

While these tumors are usually benign, they have a marked tendency to recur unless thoroughly removed, and it is probable that some of them take on an infiltrating malignant growth in the recurrence. There can be no doubt that a careful microscopic examination in every case would demonstrate malignancy in some tumors which at the first operation are considered simple papillomata.

Malignant tumors of the bladder are more common than benign. *Sarcoma* as a primary bladder tumor is rare. Wilder¹ has reported fifty cases, including three in which he examined the bladder tissues and made the diagnosis of sarcoma. His list shows sarcoma of the bladder to occur most commonly after middle life, twenty-six of these cases occurring after the fortieth year. Fourteen of the patients were children under ten years of age. Thirty-four of the cases occurred in males and thirteen in females. Apparently sarcoma of the bladder results in metastasis less rapidly than sarcoma elsewhere. But the only hope is in an early diagnosis by the cystoscope or exploratory operation and complete removal, for of his entire series only one case was considered cured as late as one year after operation.

The most common bladder tumor is *carcinoma*. This occurs usually in old people, although no age is exempt. As already stated, carcinoma may present as a papillomatous tumor which can be differentiated from the benign papilloma only by the aid of the microscope. It may likewise occur as a fungating mass extending into the lumen of the bladder, or as an indurated necrosing mass destroying the bladder wall. It may require the microscope to differentiate this latter form from benign inflammatory processes in the bladder wall.

Symptoms and Diagnosis.—There is nothing characteristic in the history of patients suffering with bladder tumor. In rare instances the patient tells of having passed pieces of tissue, but they not infrequently give this same history when suffering from exudative or exfoliative cystitis. The papillomatous forms and sarcoma sometimes appear at the external urethral orifice.

The patient reports hemorrhages, probably intermittent and extending over a long period of time and not dependent upon physical exercise. Such hemorrhages may be slight or of extreme grade, at times giving rise to clotting in the bladder

¹ Amer. Jour. Med. Sciences, 1905, cxxix, p. 63.

and retention from interference with the outflow of urine. The hemorrhages may occur at the end of micturition, particularly if the tumor projects into the urethra.

Pain as a symptom is even less characteristic than hemorrhage. Indeed, the pain is often due to a secondary cystitis, as may be a part of the bleeding and most of the other symptoms, such as frequency of urination and a purulent condition of the urine. Pain may be entirely wanting and the frequency may be due to lack of space in the bladder because of the size of the tumor.

Tumors situated about the internal urethral orifice may cause partial or complete retention of urine. I have seen a comparatively small mucous polypus act as a ball-valve over the sphincter vesicæ and cause complete stoppage during micturition.

Palpation findings are often helpful, particularly in the more fibrous forms of tumor and in the infiltrating forms of cancer. Large soft papillomata may occupy a considerable portion of the bladder and escape detection by palpation.

Cystoscopy offers the surest method of diagnosis. The presence of a tumor can be detected at once or after the removal of the blood from the bladder.

Treatment.—Small tumors may easily be removed through the cystoscope by the aid of the alligator forceps and alligator scissors, or, better still, by means of the cautery wire. Larger tumors of a benign nature can usually be removed through a vesicovaginal incision. Tumors with a broad base are usually handled most satisfactorily through a suprapubic incision. When there is any question as to the malignancy of a tumor it should be removed by the suprapubic route in order to insure a wide margin.

Every papilloma should be removed deeply in order to eradicate its submucous base. It is permissible for diagnostic purposes to remove these tumors through the cystoscope with the snare or with the alligator forceps and scissors, but this should soon be followed by the radical operation, or at least by repeated cystoscopy, so that the earliest return can be radically dealt with.

NEUROSES OF THE BLADDER.

Neuralgia of the bladder, cystalgia, hyperæsthesia vesicæ, and irritable bladder are terms used to describe conditions in which the patient suffers with bladder symptoms, such as frequency, pain, strangury, and incontinence, for which there are no discoverable physical or objective causes.

From the preceding pages the physician or the student will have concluded that a diagnosis of neurosis of the bladder should not be made if pathologic elements be present in the urine. The diagnostician must keep in mind cystalgia due to general conditions, such as, ataxia, general paralysis, and rheumatic diathesis. He must exclude reflex irritability from diseases of the vulva or vagina, and especially of the vulvovaginal and the urethrovaginal glands. Urethritis must be carefully excluded, as must trigonitis, as in either of these conditions the catheterized specimen of urine may be normal. Pelvic disorders of all varieties that might

cause a reflex bladder irritability must be excluded. I have seen severe bladder symptoms, with which changes in the urine could not be detected, caused by slight prolapse of the pelvic organs, by diseases of the uterus and of the lateral structures, particularly with paravesical tuberculosis, and by diseases of the vermiform appendix. Irritable bladder may be one of the earliest and one of the most pronounced symptoms of renal disease, particularly of tuberculosis, but in such cases a careful examination of the urine reveals pathologic elements. Hyperacidity of the urine may cause cystalgia.

The proof that cystalgia may be due to any of the above conditions lies in the cessation of symptoms on removal of the cause. After excluding all such possible causes we still have a class of cases for which refined urinalysis, cystoscopy, and other methods of investigation fail to find a cause and for which we reserve the term neuroses of the bladder.

In general they are characterized by having the frequency or irritability only during the day, the patient being able to sleep well at night. The capacity of the bladder remains normal. Polyuria is a common symptom, and the patient on certain days passes excessive quantities of clear urine of low specific gravity without special variation in the amount of water ingested. Periodically the patient may have spells of difficulty in passing water—stammering of the bladder. Sudden stoppage of the stream while urinating leads the diagnostician to think of stone or tumor.

Treatment.—The treatment should be directed toward the cure of any general neurosis the patient may present. Overworked, anemic women should be given rest and a course of tonic treatment. Hysterical girls or women of the well-to-do class with no special object in life should be directed into some channel of activity that will occupy them mentally and physically. Locally, hot sitz-baths may be of temporary benefit in the more painful cases. Electricity carried to the painful strength has occasionally given permanent results. I have had some good results by using the Hegar dilators to massage the urethra and I often overdistend the canal, carrying the dilators up to 12 or 14 mm. In addition to the dilatation I often use, weekly, applications of silver nitrate in 10 per cent. solution to the trigonum, and this sometimes relieves the condition permanently after a very few treatments. Of course, the cases relieved by the silver nitrate are those of trigonitis, even though this condition may not be distinctly evident on cystoscopic examination.

Enuresis.—Enuresis meaning incontinence of urine is a term generally reserved for the incontinence of childhood. This may be either nocturnal, only occurring at night and resulting in wetting of the bed, or it may be diurnal, or the child may have lack of control during both night and day. The condition is undoubtedly a neurosis depending upon the improper balance of the detrusor and sphincter functions.

There has been much discussion as to whether the condition is purely local, depending upon a spastic condition of the detrusor muscles or a weakness of the sphincter, or whether it is of spinal cord or brain origin. I have never been able

to demonstrate a weakness of the internal sphincter urethræ on examination of these cases.

Causes frequently assigned are chlorosis, anemia, rickets, worms, chronic constipation, and various local conditions, such as cystitis, stone in the bladder, adherent prepuce in both girls and boys, and narrow meatus in boys. Masturbation is assigned as a prominent cause of enuresis, the theory being that this practice causes congestion, irritability, and weakening of the bladder centers in the lumbar spinal cord. Beilby,¹ working in the State Industrial School at Rochester, N. Y., observed 250 cases of enuresis in three years. Of these, 75 were such marked cases that they were closely followed clinically, and in 71 masturbation was proved.

Treatment.—The treatment of enuresis is not satisfactory, as attested by the many therapeutic measures suggested for the condition. Fortunately the malady gradually disappears as the child grows older. The first requirement is discovery and removal of the cause, if this be possible. Specific internal medication is practically reduced to the use of belladonna. Drugs may be used to improve the general health. An outdoor life is indicated, and the child should not be burdened with worrying school duties. The bowels should be regulated and stimulating diet avoided. The child should not drink freely before retiring and he should be awakened at least once at night and made to urinate. This will not avail in the cases afflicted with frequent voiding. A towel tied about the waist and knotted in the back will prevent sleeping on the back and tend to keep the urine away from the sphincter. The same object is gained by having the foot of the bed elevated. Overdilatation of the sphincter urethræ as above described for irritable bladder is helpful. Faradization has many advocates. Cold packs at night, cold spinal douches, spinal massage, and vibratory spinal massage are measures directed toward improvement of the spinal reflexes.

¹ American Medicine, 1904, vol. vii, p. 397.

CHAPTER IX.
VESICAL FISTULÆ.

By H. A. KELLY, M.D.

History.—It is over sixty years since the great Johann Friedrich Dieffenbach¹ wrote in his "Operative Surgery," which was dedicated to Alexander von Humboldt, these words: "The cure of a vesicovaginal fistula forms one of the most important obligations of the surgeon. It is with sorrow that we reflect upon the imperfection of our art as we give utterance to our complaint against nature, our constant helpful handmaid, that she is here able to accomplish so little. For hundreds of years men have been searching out new methods as one by one the older methods proved themselves useless, and it is with shame that we must still acknowledge that in this field we have made but little progress, for the lucky cure of a vesicovaginal fistula must always be reckoned among rare occurrences, rarer at least than the failure of the operation."

It was soon after the public utterance of this depressing declaration that J. Marion Sims came forward and demonstrated the principles and methods by which vesicovaginal fistulæ could be healed. Through the labors of Sims and of Thomas Addis Emmet, of New York, associated with the monumental labors of Gustav Simon in Germany, followed in the course of time by a host of other laborers in this field, cases of vesicovaginal fistula have, with rare exceptions, at last been made amenable to surgery, and the reproach of the ages has been wiped away.

One of the most important contributions to this great subject is found in a book of 250 pages, published in 1868 by T. A. Emmet.² In this book Emmet gives us in minute detail, accompanied by simple but instructive drawings, the histories of a number and variety of difficult cases, selected from the abundant material which passed through his hands, for the most part in the Women's Hospital of New York City. The charm of this classic book to the serious student of the subject lies in the accurate detail regarding the steps taken and methods used in the individual cases. It was not a part of the genius of Sims, excessively occupied as he was and traveling from place to place, to dwell upon minutiae when giving his methods to the world; and yet it is only by a close attention to these minutiae that success in the end can be attained. Sims kept few or no records of his enormous work, and had it not been for the painstaking efforts of his close associate, Emmet, in making notes and in spending a vast deal of precious time in writing up the records at the Women's Hospital, we should have received from Sims but little more than the

¹ Dieffenbach: *Die Operative Chirurgie*, Leipzig, 1845, vol. i, p. 546.

² Emmet, T. A.: *Vesico-vaginal Fistula, etc.*, New York, 1868.

broad principles upon which he conducted his work. To the mind of the writer the names and reputations of Sims and Emmet must ever remain closely interwoven. Without Sims this great subject might have waited many years for its elucidation, while without Emmet many of the most important details necessary to success would never have been brought before the world, and those who attempted to follow Sims would each in turn have been forced to travel the same paths of misfortune, encountering a multitude of mortifying mistakes. In other words, Sims conceived a great plan and put it into execution, while Emmet worked it out in all its rich details, made many important additions of his own, acquired, I believe, greater technical skill than Sims, and then translated his methods to the waiting surgical world in such terms that they were able to understand and to appropriate the new teaching. The genius of Emmet is most manifest in this little book, which ought to be studied with painstaking care by every surgeon who proposes to devote any particular attention to this subject.

J. Marion Sims, in the year 1852, wrote a paper "On the Treatment of Vesico-vaginal Fistula."¹ In the same year Jobert de Lamballe² published his "Traité des fistules" in Paris. Two years later G. Simon published his celebrated monograph, "Ueber die Heilung der Blasenscheiden Fisteln" (Giessen, 1854).

In spite of the great advances made by this famous trio of surgeons, there still remained a certain number of intractable cases which were treated by Simon by the operation known as colpocleisis, that is to say, the complete occlusion of the external vaginal orifice in such a manner as to throw the vesical and the vaginal pouches into a common cloaca.³ For such a closure to be effective the urethra must be intact. Simon has given us these eight indications for this mutilating procedure:

1. Such extensive loss of tissue at the base of the bladder that the tissues cannot be drawn together.
2. Inaccessible fistulæ.
3. Destruction of the cervix uteri, bringing the peritoneum dangerously near the fistula.
4. The occurrence of severe hemorrhage into the bladder after an operation.
5. Incarceration of the cervix uteri in the bladder.
6. Atresia of the vagina.
7. Atresia of the uterus with a fistula above and below.
8. Some ureteral fistulæ.

While, judged from a purely mechanical standpoint, colpocleisis might seem to be an ideal surgical procedure, the experience of our predecessors demonstrated that it was often difficult to effect a complete closure; while the urine accumulating in the vagina was always imperfectly discharged, and being retained it was liable to

¹ Sims, J. Marion: Amer. Jour. Med. Sciences, 1852, vol. xxiii, p. 59.

² Jobert de Lamballe, A. J.: "Traité des fistules vesico-utérines, Vesico-utéro-vaginales," etc., Paris, 1852.

³ See also Bozeman, N.: "On Genital Renovation by Kolpostenotomy and Kolpocleptasis in Urinary and Fecal Fistules," Trans. Amer. Gyn. Soc., 1881, vi, 139.

become very foul; that a calculus often formed in the vagina and bladder; and further, that the patients so treated were exceedingly liable to die of an ascending infection resulting in a pyelonephritis. To obviate these objections, Rose proposed the making of a rectovaginal fistula before closing the vagina, so as to secure constant drainage, and convert the rectal ampulla into a urinary reservoir.

Perhaps no other observation could so well serve to signalize the progress made during the past forty years as the statement that colpocleisis is never done today. T. A. Emmet, indeed, by his extraordinary skill and great experience, coupled with a minute attention to details, acquired a facility which became in his hands like the famous bow of Ulysses, and was able from the first to cope with these perplexing cases which in other clinics were subjected to a colpocleisis. With untiring zeal and rare patience, he advanced through successive operations like a skilled general in the enemy's country, until he ultimately closed fistulæ which at first sight and to the untrained eye seemed utterly beyond any hope of relief short of the mutilating procedure named above.

Today, we of a later generation, wanting in both the experience and the skill of our great predecessor, deal with these difficult fistulæ by various other methods shortly to be described. A curious aftermath of some of the older methods is to be found in an operation done by Jeannel,¹ who recommends Verneuil's method of cauterizing the margins of the fistula with the thermocautery over an area of 1 to 1.5 cm., then after the slough has separated, the granulating surface is freshened by means of a curet, and the sutures are applied to close the fistula. The result of this method in Jeannel's hands, in the treatment of seven cases, was to effect three recoveries.

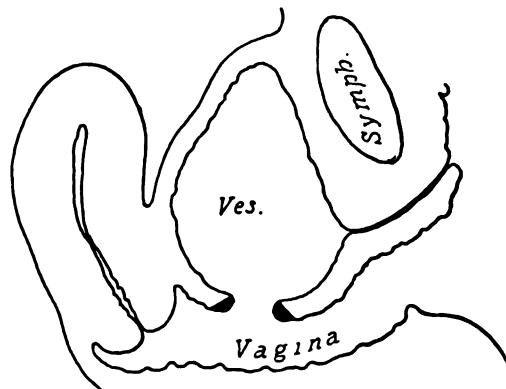


FIG. 260—A VESICOVAGINAL FISTULA.
The shaded area represents the portion to be denuded.

VESICOVAGINAL FISTULA.

A vesicovaginal fistula is an abnormal opening between the bladder and the vagina arising from a mechanical injury which results in a slough; this on becoming detached leaves a more or less patent fistulous passage between the urinary and the genital passages (Fig. 260).

The common cause of vesicovaginal and vesico-uterine fistulæ is a delayed labor in which the head has become wedged in the pelvis, and, by prolonged pressure upon the tissues at one point, has so far destroyed the vitality of the tissues that in the course of a few days or a week after labor a slough falls out, which involves some part

¹ Jeannel: *Revue Médicale de Toulouse*, 1887, p. 1.

of the entire thickness of the septum between the bladder and urethra on the one side, and the uterus and the vagina on the other. As Emmet long since pointed out, such a fistula is due, not to the improper application and use of obstetric forceps, but rather to a hesitation to put them on when the labor is delayed. The delay in the labor may be due to either a small pelvis or to the unusual size of the child, or both; or to a cessation in the expulsive pains. In order to prevent a fistula the great danger to be avoided in labor is *impaction*.

Cases of fistula are occasionally seen which owe their origin to a large or ill-fitting pessary which has gradually cut through the vesicovaginal septum.

Since the advent of hysterectomy for the treatment of cancer of the uterus and fibroid tumors, many cases of injury of the bladder resulting in fistula are traceable to this radical operation.

Fistulæ are also seen which owe their origin to the drainage of the bladder for the cure of a cystitis.

A fistula occurs spontaneously through the infiltration of the vesicovaginal septum in its upper portion with a cancer which spreads from the cervix uteri in a forward direction. With the breaking-down of the cancerous tissue, the bladder is thrown open, and the patient thenceforward experiences the intolerable added discomforts and distress of the constant escape of urine over her person, associated with the foul discharges of the malignant disease.

Diagnosis.—The diagnosis of fistula is easy enough when the defect is a large one and the parts are accessible. Under these conditions the examiner either introduces his finger into the vagina, and upon palpating the anterior vaginal wall discovers an abnormal opening which admits the tip of a finger, or perhaps of two fingers, through the vesicovaginal septum into the bladder. If a sound is introduced into the bladder through the urethra, the end of it can be brought out through the abnormal orifice into the vagina. On introducing a speculum, the hole is exposed to view, and if the case is a bad one, the rugose red bladder wall can be seen prolapsed through the opening into the vagina. One of the best possible positions in which to view the fistula is secured by putting the patient in the knee-breast position and elevating the posterior vaginal wall. In this posture the vagina becomes distended with air, and the margins of the fistula leading into the air-distended bladder become sharply defined.

If the fistula is a small one, it may be difficult to discover it until the bladder is injected and distended with an aniline solution, when the colored fluid can be seen running in a fine stream into the vagina.

By means of the injection method vesicovaginal fistulæ near the vaginal vault are best distinguished from ureteral fistulæ. If, while the bladder is distended with an aniline solution, clear fluid continues to escape from the vagina, the fistula must then be ureteral and not vesical. It is safest not to pass a catheter or a probe up a suspected ureteral fistula; an infection is very apt to follow such a maneuver.

Treatment.—The treatment of a vesicovaginal fistula depends for its success upon the following cardinal principles common to other plastic operations:

A good exposure and easy accessibility of the field of operation.

A good denudation, broad enough to secure wide apposition of surfaces to be united.

Sound vascularization of the tissues in all parts of the wound area in order to insure a quick, firm union throughout.

The use of non-irritant, non-infective suture materials, such as silkworm-gut or silver wire.

Snug apposition of the tissues by the sutures, without undue tension.

Protection of the wound after the operation from mechanical insult or injury such as might arise from an overdistention of the bladder or an improper administration of a vaginal douche.

A Simple Operation.—When the parts are flaccid, and the operator discovers by traction made with tenacula that the edges of the fistula can be readily brought into apposition, the best plan of procedure is to put the patient in the Sims position, or, as I prefer, in the knee-breast posture, and to proceed with the denudation and suturing in the following manner:

If the patient is in the knee-breast posture, the posterior vaginal wall is lifted well up with a Sims speculum which is broad enough to render the field of operation visible and easily accessible. By using the speculum, not only to lift up the perineum, but also to draw it forcibly back in the direction of the coccyx, certain fistulæ difficult of access in other postures are readily exposed. The operator, standing with a head-mirror reflecting an electric light or a direct electric light attached to his head, now grasps the margin of the fistula with a sharp rat-tooth forceps, and proceeds to denude or pare the edges with a small-bladed scalpel or a pair of delicate scissors (Fig. 261). The denudation must extend into the vesical mucosa on all sides. If the fistula is angular, it is best to extend the denudation well beyond the angles. If the septum is a thick one and the opening more like a punched-out hole, the denudation need involve little more than the thickness of the septum. If, on the contrary, the septum is thin, it will be necessary to extend the denudation more out upon the vaginal surfaces. After completing the denudation on all sides and making sure that there are no undenuded areas left behind, sutures are passed so as to bring the tissues together in the lines of least resistance, whether in a direction horizontal to, oblique, or in the axis of the vagina (Fig. 262). I prefer for my part to use as a suture material a fine thread-like silver wire which can be tied like a string. Fine silkworm-gut is also an excellent suture material. It is best not to depend upon catgut, which becomes

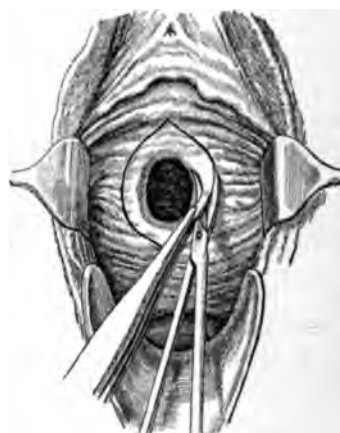


FIG. 261.—PATIENT IN DORSAL POSITION WITH FISTULA EXPOSED.

The delicate curved scissors used in the operation are engaged in cutting off a strip of vaginal mucosa on all sides of the fistula.

absorbed too readily, or upon silk, which is likely to become a carrier of infection. A fine curved cutting needle armed with a silk loop-carrier is the best way of introducing the sutures. The advantages of the knee-breast posture in effecting these

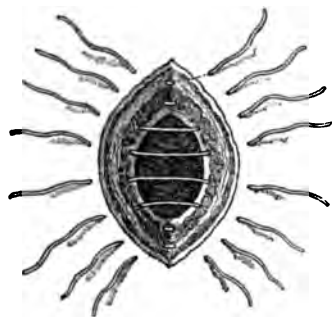


FIG. 262.—THE FISTULA DENUDED SHOWING SUTURES IN PLACE, ENTERING AND EMERGING ON THE VAGINAL WALL, READY FOR ITS CLOSURE.

manipulations are, the easy accessibility of the parts and the comfortable position in which the operator works, as he looks down upon the field of operation. It is also an easy position for the assistants, who do not have to stoop. Furthermore, any bleeding which takes place is lessened by the air-distended condition of the parts, and any slight bleeding takes place into the bladder instead of covering the wound and so hindering the operation.

After-treatment.—The after-care is of the utmost importance. The best plan is to insert a mushroom catheter (Fig. 263) into the bladder and leave it there for from six to eight days. The bowels should be kept closed for about three days.

If the catheter becomes clogged, it must be changed, and if a mild cystitis is set up, the bladder should be irrigated through the catheter with a warm boric acid solution.

When the tissues have been brought together with ease and a thorough snug apposition has been secured, it is sometimes possible to secure a good result by doing away with the drainage catheter and allowing the patient to urinate from every three to six hours, according to the amount of secretion.

It is important in making the denudation not to cut widely on the vesical mucous surface. Serious and even fatal hemorrhage has taken place from this error. Again, the bladder has become so distended with blood that the patient with a powerful and uncontrollable expulsive effort has burst open the stitches and expelled a huge clot through the vagina.

It is also important in passing the sutures not to commit the terrible mistake of including one or other of the ureters. In many such instances it has been found necessary, on account of severe and increasing pain in the kidney, to take out the sutures so as to free the ureteral orifices. When both orifices are caught, there is, of course, anuria. This accident will be avoided by noting the position of the ureters, or at least by noting with care that one or both orifices do not debouch upon the margin of the fistula. It is furthermore important to avoid passing the sutures with a wide sweep into the surrounding tissues.

Complicated Cases.—Complications are conditions which render it difficult to deal with a fistula so as to secure the conditions above referred to as neces-

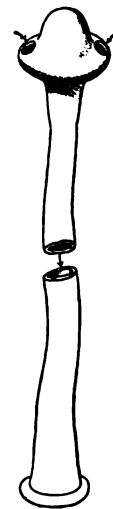


FIG. 263.—A MUSHROOM CATHETER.

sary for the uniform success of a plastic operation. I shall now briefly consider some of these complications:

Small Fistulæ.—Paradoxical as the statement may seem, a tiny fistula, as long noted by gynecologists, is often more difficult to treat successfully than a big and wide opening. There are two reasons for this. In the first place, when the opening is so small, the operator is liable to treat it as an insignificant matter and he does not do so thorough an operation. *Per contra*, a small fistula should be accorded the same careful attention as to details, including the broad denudation and the accurate suturing, as a large opening. If this is not done, a large percentage of failures will inevitably be the result.

In the second place, a small fistula almost always represents the residuum of a large opening which has healed down to this point, or it constitutes the outcome of a previous partially successful operation. A fistula forming under these circumstances is apt to present a thin, membranous, devitalized margin, which is but ill adapted for plastic union. In order to insure success, the operator must overcome his natural reluctance, enlarge the opening, and make a wide denudation before he attempts to close it.

Large Fistulæ.—When the fistula is so large that it is impossible to bring the vaginal walls together one of several plans may be adopted for its closure. In the first, the margins of the opening may be split apart on all sides so as to detach the loose flaccid bladder from the rigid unyielding vagina. The bladder, thus sufficiently freed, may now be closed by two tiers of catgut sutures which turn up a ridge of tissue on the vesical surface. The vaginal surface may then, in case of necessity, be left to granulate over, under the careful protection of an iodoform gauze pack (Fig. 264). When the fistula is high up at the vaginal vault and more or less immobile, Jobert, Emmet, and others, have utilized the anterior lip of the uterus to close the defect by denuding it on all sides and then sewing it into the gap in the septum. The cervix may be split in a horizontal direction so as to set it free for this purpose. Again, the posterior lip has been used in the same way, in this case turning the uterine cavity and its periodic discharges into the bladder, so that menstruation, from the time of the operation, must take place through this organ and be discharged *per urethram*. This latter plan has been used more especially in intractable cases of vesico-utero-vaginal fistula. They belong rather to the generation which has just preceded us, which was the first to exploit this great field of surgery. The surgeons of today have simpler and better methods at their disposal.

Fistula Adherent to the Pubic Ramus.—Such fistulæ are difficult because they are



FIG. 264.—A LARGE FISTULA WITH RIGID VAGINAL WALLS.

The bladder has been dissected loose on all sides and sewed up as represented, infolding a ridge in the lumen of the bladder. The suturing should be closed. With careful dressing this fistula may heal without approximation of the vaginal walls.

exceedingly awkward to expose, and when they are at last denuded they are most difficult to suture effectively. The best plan in these cases is to detach the bladder, setting it entirely free from the bone and then sewing it to the adjacent denuded fistulous margin.

Scar Tissue.—When there is a great deal of scar tissue in the vaginal walls which renders the fistula immovable, it is often surprising how easily such a case, which at first sight seemed impossible, can be successfully treated, and brought almost



FIG. 265.—SICKLE-SHAPED KNIFE, SHARP ON BOTH SIDES, FOR THE DISSECTION OF THE BLADDER FROM THE VAGINAL TISSUES IN A VERICOVAGINAL FISTULA.¹

within the category of the group of simple cases. Where there is abundant scar tissue the matter is often simplified by dissecting out the scars on all sides and in this way freeing the vagina from its constricting bands. If this is not sufficient to mobilize the tissues, the vagina is further undermined on all sides in the neighborhood of the fistula so as to set the bladder entirely free. A knife like that shown in Fig. 265 facilitates the separation. After doing this, the loose, flaccid

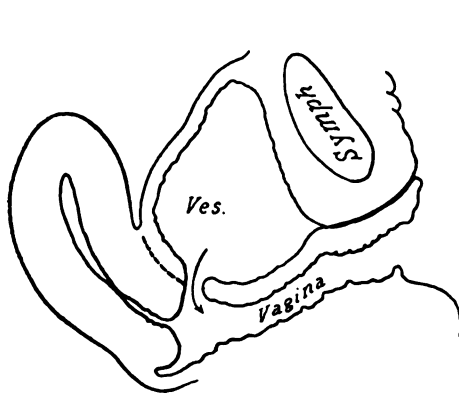


FIG. 266.—A VESICO-CERVICO-VAGINAL FISTULA. The dotted line shows the line of incision, or rather dissection, made to free the bladder from the uterus.

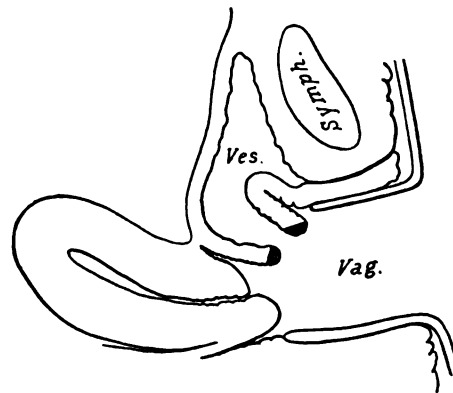


FIG. 266 a.—THE VESICO-CERVICO-VAGINAL FISTULA SET FREE, AND THE FISTULA BROUGHT DOWN READY FOR SUTURE.

bladder is first sewed up as an independent organ, using catgut sutures, then the vaginal tissues are drawn together, with the interrupted fine silver wire sutures, here and there catching a suture in the underlying bladder, so as to hold the two surfaces in apposition, and to obliterate any dead spaces.

Eliminating the difficult cases which can be successfully treated by one or other of the methods just described, there still remain several groups of cases which are not amenable to treatment by any of these procedures.

¹"The Treatment of Vesico-vaginal and Recto-vaginal Fistulæ High up into the Vagina," Johns Hopkins Hospital Bulletin, 1902, vol. xiii, p. 73.

A fistula at the vault of the vagina, pinned to the anterior wall of the uterus and associated with more or less extensive loss of cervical tissue (Fig. 266), is best treated by detaching the bladder from the uterus to a point well above the fistulous opening, even as far as the peritoneal reflection. A fistula dissected out in this way, whether it is located directly at the vaginal vault or whether it opens into the cervical canal above the vault, can readily be cured by uniting the flaccid bladder walls with two layers of buried sutures. The first layer should be of catgut, while fine intestinal silk or silkworm-gut may be used for the second layer. If fine silk sutures are used next to the bladder no part of the loop should appear on the vesical surfaces. After the exposure and closure of the fistula it is a good plan to slip a little iodoform gauze drain into the interval between the uterus and the closed opening. The uterine portion of the fistula can be safely neglected. When the fistula is high up or extensive, no hesitation need be felt in completely detaching the bladder from the uterus (Fig. 267 *a*), even to the opening of the peritoneal cavity, and drawing the peritoneal portion of the bladder down into the vagina so as to aid in making up a part of the defect.

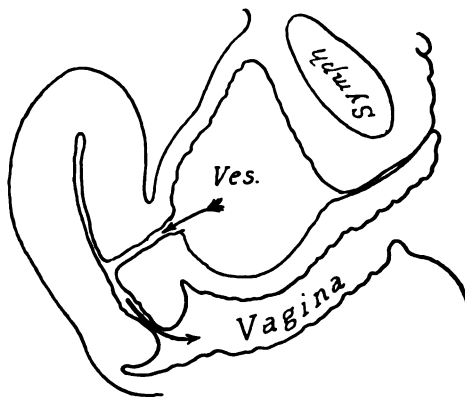
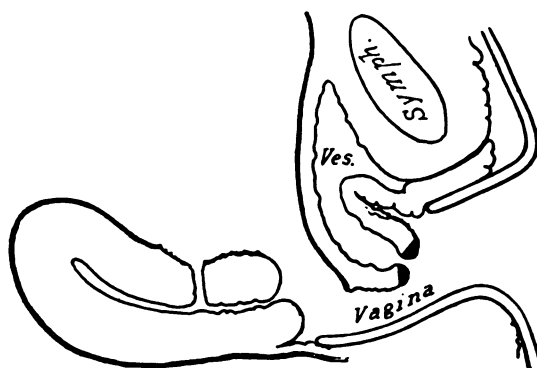


FIG. 267.—VESICO-UTERINE FISTULA.

FIG. 267 *a*.—VESICO-UTERINE FISTULA TREATED BY COMPLETE DETACHMENT OF THE BLADDER FROM THE UTERUS, AFTER WHICH THE FISTULA IS SEWED UP.

The peritoneal opening may then be backed, or the peritoneal surface of the bladder may be attached to the uterus as before, or the bladder may be caught at a high point and attached to the uterus.

with cases of pelvic inflammatory disease, to first remove the uterus, uterine tubes, and ovaries, in this way entirely liberating the bladder, and then to sew up the now accessible fistula by continuing the operation through the abdomen and bringing the bladder walls together in two layers with catgut and fine silk, or with silk alone.

A vesico-uterine fistula (Fig. 267), or a fistula at the vault of the vagina, can sometimes be reached best by opening the abdomen above, detaching the bladder entirely from the uterus, and sewing the fistula up in this way. In such a case it will be best to drain in the direction of the vagina.

I have found it an excellent plan, in cases of fistula associated

RESTORATION OF THE URETHRA.

One of the most difficult feats in surgery is the restoration of a urethra which has sloughed away in whole or in part. A simple fistula in the floor of the urethra is to be repaired like a vesicovaginal fistula by the denudation of its margins and union in the direction of least tension by interrupted sutures.

When a part only, as, for example, even a section of the urethra is sacrificed, a good result may be obtained by denuding the upper and lower ends, and making an end-to-end anastomosis with fine silkworm-gut or fine silver wire. Two other forms of injury are occasionally seen in which the urethra appears entirely

lost, and the opening into the bladder is merely a hole at the vesical neck, opening into the vagina like a hypospadias, into which oftentimes the index-finger can easily be thrust.

In one of these forms a close examination shows a strip of urethral mucosa representing the upper or anterior urethral wall, lying under the pubic arch and continuous with the vaginal mucosa, perhaps connected with some redundant folds, the remains of the retracted urethra, on either side. In the other there is no trace whatever of any urethra to be discovered.

Such a profound destruction of the urethra as is present in either of these



FIG. 268.—NOBLE'S CASE OF ABSENCE OF THE URETHRA.

a, The clitoris; b, the artificial urethral orifice; c, the right labium minus; d, the left labium minus transplanted to form a new urethra; e, the anterior vaginal wall.

cases is fortunately but rarely found as a sequela to labor, however difficult. In two instances seen by me, and in one seen by C. P. Noble, the extensive injury done the urethra was due to an ill-judged surgical operation. In one of my patients, a surgeon (?), undertaking to remove some "urethral hemorrhoids," extirpated the whole urethra down to the bladder. In C. P. Noble's case (Fig. 268) a doctor who desired to remove "a blue spot" in the anterior vaginal wall cut away the floor of the urethra, destroying the entire canal, and leaving a large hole at the neck of the bladder.

Noble¹ secured a good result by adopting the following plan: He made a lateral denudation in the folds on each side and sutured the strip of mucosa representing the anterior wall of the urethra over a small sigmoid self-retaining catheter, in this way forming the lining membrane of the new urethra. The channel thus constructed was continued up over the vestibule as far as the clitoris, much as Emmet has done in similar cases.

The left labium minus was then divided on a level with the urethra and detached from above downward to its inferior base. This structure was then unfolded and turned in toward the vagina; its unfolded raw surface was next used to cover in the exposed raw area forming the under surface of the urethra, by attaching it by numerous catgut sutures. Firm union was obtained, and with the aid of a small tampon introduced within the vagina to make pressure upon the internal orifice of the urethra, the patient was enabled to retain her urine for a number of hours in the daytime and to sleep soundly at night (Fig. 268).

In my own patient (Mrs. M. M. J., San. 952, May 22, 1900, etc.) the entire urethra had been cut away leaving a large hole corresponding to the neck of the bladder, without any trace of a sphincter muscle.

I constructed a urethra 2 cm. long and 2 mm. in diameter in the following manner: In the first place, I tunneled a channel just above the vestibule and under the symphysis pubis up to the vesical opening. I then dissected loose a broad tongue of tissue in the anterior vaginal wall, with its apex above and its base at the opening of the bladder (Fig. 269). Carrying a pair of forceps through the hole made above the vestibule, this tongue was grasped and pulled through the tunneled channel and attached by delicate fine silk sutures to its outer extremity (Fig. 269). In this way the newly made canal was brought into direct relation with the bladder, and was at the same time lined with epithelium so as to prevent its closure. The operation succeeded down to two small fistulous orifices at each end of the hole in the bladder. These were subsequently closed, when the patient's condition was improved, as she could retain her urine in the recumbent posture. There was no contractile power in the new



FIG. 269.—FORMATION OF A NEW URETHRA.

A channel is made under the tissues beneath the symphysis from a' to b, within the area cc. to cc. A flap is then loosened around the opening in the bladder at b, and drawn through the new canal so as to form its floor.

¹Noble, C. P.: "The New Formation of the Female Urethra," *Amer. Jour. Obst.*, 1901, vol. xliii, p. 170.

urethra, and she leaked badly when on her feet. It only needed a little pressure on the minute newly made urethra to secure perfect control, and I accomplished this by means of a pessary. At first I had an ordinary pessary made bearing a hard-rubber ball on its anterior bar which just filled the vulvar orifice and so

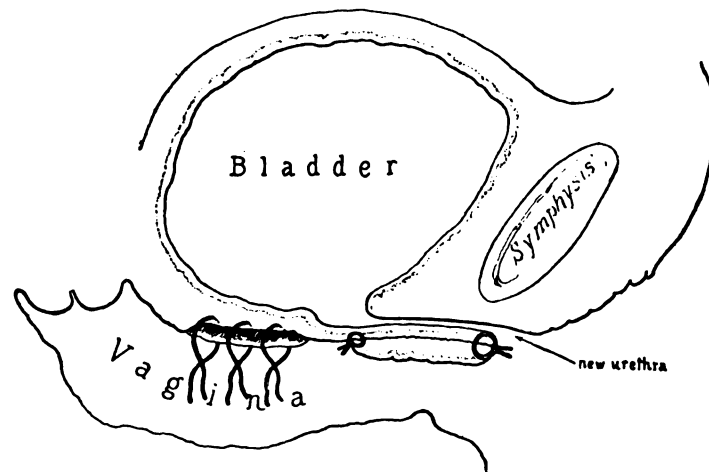


FIG. 270.—THE EFFECT OF THE OPERATION DESCRIBED IN FIG. 269 IS SEEN HERE.

The flap has been drawn forward and is united by sutures at its anterior and posterior ends to the floor of the new canal. The raw space left in the vagina is closed by a series of transverse sutures, shown in the figure still untied.



FIG. 271.—A SMITH PESSARY, WITH A HARD-RUBBER PESSARY RESTING ON TWO PILLARS, FOR THE PURPOSE OF MAKING PRESSURE ON THE NEW URETHRAL CANAL AND IN THIS WAY SUBSTITUTING THE LOSS OF THE SPHINCTER MUSCLE.

pressed upon the urethra. This brought about some improvement, but the control was not perfect until I constructed another pessary of the form shown in Fig. 271, bearing a hard-rubber cushion upon two little pillars which made just enough pressure to give complete control.

CHAPTER X.

THE PREPARATORY TREATMENT OF CELIOTOMY CASES.

BY CHARLES P. NOBLE, M.D.

Both the preparatory and after-treatment of celiotomy cases should be carefully and systematically carried out. This is especially true when it is necessary to operate upon feeble patients and when operations of magnitude must be performed.

General Considerations.—In the average case the preparatory treatment should begin at least two days before operation. If the patient is to be operated upon in a hospital, she should be admitted forty-eight hours before operation; if at home, she should be restricted in her movements for the same length of time. This is important for many reasons; among which are to prepare the field of operation, to empty the alimentary canal, and to prevent the patient from taking cold. It happens not infrequently in emergency operations that the patient has taken cold just before operation, which develops into an "ether pneumonia." A full bath, preferably a tub bath, should be taken daily, and special care should be exercised to cleanse thoroughly the abdominal wall. A daily douche of two quarts of bichlorid of mercury solution (1 : 4000) or other germicidal solution should be employed unless there should be some indication to the contrary. The diet should be restricted to simple, easily digested food, and water should be drunk freely at regular intervals. The free ingestion of water is of value not only to flush the kidneys and to stimulate the action of the skin, but also to lessen suffering from thirst after operation.

Emptying the Alimentary Canal.—Special care should be given to the thorough emptying of the alimentary canal. This is most important when chronic constipation has been a symptom. My own experience amply bears out the teaching that when this is not done patients may suffer from autointoxication from the absorption of ptomains or toxins from the intestines after operation. I have seen several deaths which could be explained in no other way, and numerous cases in which patients were seriously ill from autointoxication from the absorption of the contents of the bowels after operation. Two or three grains of calomel should be given in divided doses forty-eight hours before operation, to be followed by repeated doses of a saline purgative, such as Epsom salts or citrate of magnesia, sufficient to freely purge the patient. In the forty-eight hours before operation the bowels should move four or five times. When patients have suffered long from chronic constipation, the bowels should be unloaded by cathartics and by irrigation of the colon for a week before operation. When the bowels have been impacted this is often indicated by the passage of dry fecal matter in the form of grains. Whenever such passages are noted, the purgatives and irrigation of the colon should be continued

until this material has all been evacuated. The use of ox-gall (5j-5iv) added to the saline solution for irrigating the colon is of distinct value in such cases. On the morning of operation a final evacuation of the bowels should be secured by the use of a large enema of normal salt solution.

Preparation of Feeble Patients.—The preparatory treatment of feeble patients should be more prolonged. Formerly it was the habit of surgeons to prepare all patients for several weeks before operation, but this is certainly not desirable in those in good general health. In the case of feeble patients much can be accomplished by systematic preparatory treatment. Among the poor very frequently a feeble woman is obliged by necessity to continue arduous household labors until her admission to the hospital, so that she is depressed both by disease and overwork. Such patients improve very much with rest in bed, baths, nutritious food, the stimulation of the emunctories, and the administration of suitable tonics, such as strychnin, tincture of calumba (or another bitter), malt, and in anemic patients an eligible preparation of iron. When the indication for operation is not immediate and the condition of the patient is distinctly bad, the systematic use of massage as an adjuvant to the other tonic treatment is to be recommended. When the heart is feeble strychnin sulph. gr. $\frac{1}{30}$ and tr. digitalis η xx, given three or four times daily for several days before operation, are especially to be recommended.

The improvement in the vitality of feeble patients is of value not only to avoid shock in such cases, but also to increase their resistance to infection. It has been definitely proved that the resistance to infection is much less in those having reduced vitality than in others.¹

Preparation of Emergency Cases.—In emergency cases, such as ruptured extrauterine pregnancy, the rupture of tumors or of abscesses, and cases of peritonitis seen late by the surgeon, it is often necessary to dispense with preliminary treatment and only to employ so much as is feasible while the preparations for operation are being hurriedly completed. It is important in such cases to empty the bowels by enemas if the condition of the patient will permit. The preparation of the abdomen for operation can be completed while the patient is being anesthetized, and this period should be used for the disinfection of the field of operation in order to lessen the duration of anesthesia.

Examination of the Heart.—A routine examination should be made to determine the condition of the heart, the lungs, and the kidneys. Heart lesions have less influence upon the result of operations than is commonly believed. Valvular lesions when compensated for by hypertrophy seldom cause trouble after operation. It is a good working rule, that if the patient has no evidence of cardiac weakness in the form of edema of the extremities, cough, or shortness of breath on climbing stairs, or when performing her usual duties, the heart lesion will not interfere with recovery from operation. Degenerative changes, such as marked dilatation of the heart, fatty and fibroid degeneration, and brown atrophy, are the conditions most to

¹ Flexner, S.: "A Statistical and Experimental Study of Terminal Infections," *The Journal of Experimental Medicine*, vol. i, No. 3, 1896.

be feared. This is not the place to discuss the diagnosis of these conditions, but they can be excluded whenever the apex-beat of the heart is normally situated and the patient has a normal pulse. The cases requiring expert study are those presenting symptoms of heart disease and in which the heart-sounds and pulse indicate cardiac weakness.

Anemia should be considered a contraindication to operations in general when it is extreme. In all such cases a careful study of the blood should be made, and when the percentage of hemoglobin falls below or even approaches 30 per cent.,¹ preparatory treatment should be instituted before operation. When the anemia is due to hemorrhage which cannot be controlled without operation, the prognosis is correspondingly grave. In chronic anemia, especially when induced by long-continued hemorrhages from fibroid tumors, degenerative changes in the heart are common.²

Examination of the Lungs.—The condition of the lungs has a positive bearing upon recovery from operations, and is especially to be considered in connection with anesthesia. Ether usually acts as a positive irritant when inhaled by a patient having inflammatory lesions in the lungs, especially when these are acute in character. For this reason, as a general statement, when operation becomes necessary in a patient suffering from such lesions, chloroform should be chosen rather than ether, as it is far less irritating to the lungs. When chronic inflammatory lesions are present, whether consumption or chronic bronchitis, whenever possible, operation should be done only when the inflammatory lesions are quiescent. In the presence of acute inflammation of the pulmonary organs, whether pneumonia or bronchitis, operation is positively contraindicated, except in cases of extreme necessity, such as hemorrhage from a ruptured extrauterine pregnancy, and intestinal obstruction. In such cases chloroform rather than ether should be selected. When this rule is neglected, severe acute bronchitis and even pneumonia are common results of etherization. In this class of cases anesthetization by the injection into the spinal canal of eucaïn, cocain, or stovain may prove of service.

Examination of the Kidneys.—The routine investigation of the condition of the kidneys is most important. In this investigation not only should the urine be examined, but also the history of the patient, and the condition of the heart and blood-vessels should be taken into consideration. Patients suffering from nephritis, either acute or chronic, are far less able to withstand operation than those having normal kidneys. The urine should be examined chemically and microscopically at least on two different days before operation. When the history of the case, the appearance of the patient, or the existence of arteriosclerosis suggests the likelihood of chronic nephritis, a more careful and prolonged study should be made. In these cases the total amount of urine passed *per diem* should be measured, and the functional activity of the kidneys estimated by comparing the specific gravity

¹ Cabot, R. C.: "Chemical Examination of the Blood," third edition, p. 129.

² Freund, H. W.: "Beziehungen der weiblichen Geschlechtsorgane zu andern Organen, in Lubarsch und Ostertag's Ergebnisse den Allgemeines Pathologie," etc., Wiesbaden, 1898.

with the total amount of urine passed, and by determining the percentage of urea which it contains; also by comparing these results with amount and character of the food ingested. The routine examination of the urine should embrace the determination of the specific gravity and the presence or absence of albumin, sugar, indican, tube casts, blood, pus, and urinary sediment, amorphous or crystalline. With a negative report upon these points nephritis and diabetes can usually be excluded. It has happened not a few times in my experience that cases of chronic Bright's disease have been overlooked when the examinations were made by trained men. The presence of indican in the urine is indicative of the absorption of toxic matter from the bowels. When present in the urine special care should be taken to have the bowels thoroughly evacuated before operation.

Operation should be done upon *diabetic patients* only when the indication is strong. It was formerly believed that wounds in diabetics were prone to suppurate and to slough. This opinion was probably based upon the experience of surgeons when operating for diabetic gangrene. Unless the nutrition is profoundly altered, wounds heal kindly in diabetics. The chief danger from operation is that the shock of the operation may lead to the occurrence of diabetic coma. Operation upon diabetics is proper when the nutrition is good, the general symptoms of diabetes absent, the percentage of sugar low (about 1 per cent.), and the indication one of *more than average* urgency.¹

Operations upon Patients Having Kidney Lesions.—The relation between inflammatory lesions in the kidneys and the results of operations is by no means simple. My own experience indicates that with the usual methods of investigation it is very difficult to estimate accurately the gravity of lesions of the kidneys. The persistent presence of albumin and tube casts other than hyaline in the urine is indicative of Bright's disease, either acute or chronic; but such a diagnosis should not be made simply because tube casts are found at a given period. About 5 per cent. of patients requiring gynecologic operations have casts, and a much larger percentage have albumin in the urine before operation. The percentage is much higher after operation.² The presence of tube casts and albumin occurring after operation is usually transient. In considering this question from the standpoint of operation, the nature of the kidney lesion and the nature of the operation must always be taken into account. In the case of large tumors not infrequently the nephritis is brought about by congestion due to the pressure of the tumor. This is also due at times to the pressure of fibroid or other tumors impacted in the pelvis and pressing on the ureters. In other cases the kidney lesion has its starting-point in infection and exudate in the pelvic peritoneum. In such cases, especially when caused by tumors, operation serves to remove the primary cause of the nephritis. The character of the operation is also most important. A patient having nephritis

¹ Noble, Charles P.: "Three Operations upon Diabetic Patients," Amer. Journ. Obstet., 1899, vol. xxxix, No. 2, p. 182; discussion of same, p. 187; "Personal Experience in Operations upon Diabetic Patients," Amer. Medicine, 1903, vol. vi, No. 13, p. 511.

² Kelly, H. A.: "Urinalysis in Gynecology," Amer. Jour. Obstet., 1893, vol. xxviii, p. 429. Noble, Charles P.: "Relations of Certain Urinary Conditions to Gynecological Surgery," Amer. Jour. Obstet., 1893, vol. xxviii, p. 753.

may be able to withstand an operation which can be done quickly, with the loss of but little blood and without shock, who would succumb to one of greater magnitude. Such patients do not react well from shock.

After having given much attention to this subject during the past sixteen years, my conclusions are far from satisfactory. Tube casts, especially hyaline and granular, appear and disappear so frequently while patients are under observation before and after operation, and are unaccompanied by symptoms indicating nephritis or renal insufficiency, that I have long been convinced that their significance is greatly overestimated. The mere presence in the urine of hyaline or granular casts is not a contraindication to operation. In such patients the preparatory treatment should be more prolonged, water should be prescribed in large amounts, and the condition of the skin and alimentary canal should be given special attention. More than usual care should be taken in such cases to protect them against being chilled during operation. A liter or more of normal salt solution should be introduced into the abdomen before closing the incision. Enemas of salt solution and hypodermoclysis should also be employed.

When acute or subacute nephritis exists, as indicated by the presence of albumin, large granular and epithelial casts, all operations except those of the most urgent character are contraindicated. Chronic nephritis with advanced degenerative changes in the kidneys contraindicates operation, except the indication be urgent. The procedures advised for cases of kidney irritation should be strictly followed in these cases. They do not react well from shock. Death from suppression of urine is not infrequent.

Fixing the Date of Operation.—When the indication for operation is not urgent, the date should not be fixed unless the general condition of the patient is good. Complicating conditions should be cured as far as possible before setting the day for operation. The *morale* of the patient is a factor of importance, not only in recovery from operations but also in lessening mental distress and in rendering convalescence easy and satisfactory. For this reason the mental condition of the patient should not be neglected. Operation having been decided upon, she should be made to feel that her prospect of recovery is good, and she should receive only support from surgeon, nurse, and friends. It is of importance that the patient should sleep well on the nights immediately preceding operation. Should her sleep be disturbed, trional grs. v-xv, or sodium bromid grs. xxx, should be administered at bedtime, and repeated if necessary.

On the morning of operation breakfast should be omitted, and only a cup of broth or of clear coffee allowed. After the special preparation of the abdominal wall has been made (see p. 522), it is important that the patient be kept warmly wrapped until anesthetization is begun. Just before the anesthetic is administered the bladder should be emptied. Either the patient should void her urine or the catheter should be passed. When retention of urine has been a symptom the catheter should be employed. It is important to have the bladder empty, not only that it shall not disturb the surgeon during the operation, but also because it

is much less likely to be wounded when opening the abdomen. The anesthetic should not be administered in the room selected for operation. Either the anesthetic should be given to the patient in her own room, or she should be transferred to a room adjoining the operating room. To see the preparations made in the operating room is an unnecessary ordeal which she should be spared.

CHAPTER XI.

AFTER-TREATMENT OF CELIOTOMY CASES.

BY CHARLES P. NOBLE, M.D.

As a general statement, it may be said that the result of an abdominal section is determined when the patient leaves the operating table. This rule is not without numerous exceptions. The exceptions are most common in the more serious cases, and especially in those in which, owing to the conditions present, a thoroughly satisfactory technic has been impossible, and it has been necessary to employ drainage. In the class of very serious operations, and in operations upon patients of feeble vitality, judicious or injudicious after-treatment frequently determines whether the result shall be favorable or unfavorable; and in all cases it is doubtless true that recovery is favored and convalescence made smoother by judicious after-treatment.

Care of Patients Immediately after Operation.—Immediately after operation our efforts should be directed to restoring the patient to consciousness, to combating shock if present, and to promoting reaction from the depressing effects of the operation. The after-treatment, so far as the anesthesia is concerned, should begin before the conclusion of the operation, in the latter stages of which a good anesthetist will withdraw the anesthetic either wholly or in part, so that at the completion of the operation the patient shall already have recovered from the surgical degree of anesthesia. At this stage the effects of the anesthetic should have sufficiently passed off for the reflexes to be present. The usual course when the operation is completed, is to remove soiled clothes and replace them with a clean and well-warmed suit. The patient should then be wrapped in blankets and transferred to her bed. She should be strictly watched until reaction has taken place and consciousness has been reestablished. Death from the anesthetic is possible at this stage, should this precaution be neglected, if the breathing becomes obstructed. To combat shock and promote reaction the patient should be surrounded by hot-water bottles. The water in these bottles should preferably not be above 165° F., and they should be separated from the patient by the blanket. Lack of care in this regard frequently results in the formation of hot-water burns. Care should be taken that the hot-water bottles are water-tight, as patients have been scalded by the leakage of water from defective bottles.

Enemas of warm salt solution (℥ viij—Oiv), either alone or containing stimulants, such as whisky ℥j-℥ij or carbonate of ammonia grs. xv, are to be recommended. An enema of salt solution should be given in every case, unless there be reason to suspect that the bowel wall has been damaged during the operation. When the

patient is feeble or shock is present, a stimulant should be added. The foot of the bed should be elevated 8 to 12 inches whenever shock is present, or when salt solution has been left in the peritoneal cavity. The routine injection of strychnin sulph. gr. $\frac{1}{15}$ and normal liquid digitalis mij hypodermically, is to be commended. The administration of oxygen promotes the early recovery of the patient from the effects of the anesthetic, and is also believed to lessen post-operative nausea and vomiting. These measures are usually sufficient to restore the patient to consciousness and to bring about reaction.

The First Twenty-four Hours.—During the first twenty-four hours the average patient requires more watching than treatment. At first hot water, ℥ss , every two hours may be allowed, and later—the following morning, as a rule—if the stomach is tolerant, the same amount of water, either hot or cold, or soda water, may be given every half hour. Except when contraindicated by the condition of the bowel, the routine use of enemas of warm salt solution (℥ viij) every six hours is useful in supplying water to the circulation, in lessening the suffering from thirst, and in promoting diuresis. The administration of strychnin sulph. gr. $\frac{1}{30}$ — $\frac{1}{15}$ every six hours, hypodermically, tends to brace up the nervous system and to stimulate the heart. When the pulse is feeble or rapid, normal liquid digitalis (mij — ij) should be added. In extreme cases camphorated oil (℥xxv) may be given hypodermically every six hours. If the patient is restless or has much pain, codein phosphate (gr. $\frac{1}{2}$) should also be added. If pain is a marked symptom, one or two small doses of morphin (gr. $\frac{1}{8}$) may be administered with advantage; or a suppository containing the following:

R.	Ext. opii.	gr. $\frac{1}{2}$
	Ext. hyoscyam.	gr. $\frac{1}{2}$
	Codeinæ sulph.	gr. $\frac{1}{2}$
	Ext. cannabis indic.	gr. $\frac{1}{2}$
	Ol. theobrom. q. s.	
M.	ft. suppos. No. j.	

may be given instead of the hypodermic of morphin.

The question of *the administration of morphin or opium after abdominal section* is one which has been much discussed. Undoubtedly at one time morphin was used much too freely, with the result that it was difficult to move the bowels, the stomach was upset, tympanites was promoted, and the patient was rendered less comfortable than without its use. In cases of peritonitis of moderate grade it is probable that the use of morphin favored the extension of the disease by interfering with the influence of purgatives in opening the bowels. On the other hand, there can be no doubt that the bad influence of morphin has been greatly exaggerated by Tait and his disciples. Probably no one at the present time would seriously contend that the administration of morphin would cause septic peritonitis, or, on the other hand, that it would cause death from this condition by preventing the action of purgatives, as it cannot be claimed that purgation can cure septic peritonitis. It is a wise general rule to avoid morphin. It is my own habit to use codein or the suppository above given to control pain of ordinary degree; but when pain is extreme and the

patient is much disturbed and restless, nothing but morphin will control it, and under these conditions it is to be advised.

When the patient has completely reacted, if the skin is wet from perspiration, and particularly if it is clammy, it is desirable to dry the skin thoroughly and to change the underclothing if this is indicated. If the skin is notably "leaky" the administration of atropin sulph. gr. $\frac{1}{150}$ - $\frac{1}{100}$ is useful. This is even more useful when bronchorrhea has been caused by ether, with resulting congestion of the lungs.

The Second Twenty-four Hours.—If the stomach is tolerant, the amount of water should be increased until thirst is assuaged. If nausea and vomiting occur the water should be decreased in amount or withheld. Sometimes, if vomiting is annoying, and especially if it is bilious in character, the administration of several glasses of warm water, so as to promote vomiting and wash out the stomach, acts nicely in settling the stomach. When bilious vomiting is persistent nothing is so useful as to wash out the stomach through a stomach-tube. In addition to relieving nausea this is often of value by preventing autointoxication by absorption from the stomach. Calomel is the most eligible purgative, because it can be given at this time when other purgatives would probably cause nausea and vomiting. From two to three grains may be administered either in a single dose or in divided doses. When nausea is present, fractional doses are preferable. What has been said concerning the use of enemas of salt solution and hypodermics of strychnin, digitalis, etc., on the first day, is equally applicable to the second. Nourishment at this stage is of but slight value. If desired, a meat broth—such as chicken, mutton, or beef—in amounts of from half an ounce to two ounces, may be given every two hours. Albumin water, plain tea without sugar or cream, and milk and lime water, are also eligible food preparations at this period. The routine use of milk before the bowels have acted is to be deprecated, as in some cases it promotes flatulency.

The position of the patient is a question of some importance. It is my own observation that in general patients are much more comfortable when restricted to the dorsal position. This rule has exceptions, and some patients are more comfortable on the side than on the back. In general it is best to keep them on their back, if they are contented in that position. Certain patients, if moved from one position to another, become restless and fretful unless their position is frequently changed. When salt solution has been left in the peritoneal cavity at the conclusion of the operation, it is desirable to change their position from the dorsal to the lateral posture at least every six hours, to promote the diffusion of the salt solution throughout the peritoneum.

The Third Twenty-four Hours.—Toward the end of the second day or the beginning of the third a brisk purgative should be administered. For this purpose Epsom salts, Rochelle salts, or citrate of magnesia solution are to be preferred. The following is a favorite formula:

R.	Magnesii sulph.	3ij
	Acid. sulphuric. aromat.	ʒv
	Syr. zingiberis.	3ij
	Aque.	3ij
M.		

This amount, or double the amount, may be given every two or three hours until the bowels move. If the stomach is rebellious to Epsom salts, a concentrated preparation of solution of citrate of magnesia is often more grateful. A standard preparation may be made, four ounces of which is equivalent in strength to a bottle of citrate of magnesia solution. This may be given in doses of a half ounce to two ounces every two hours until the bowels are moved. When it is suspected that there will be difficulty in moving the bowels, or when it is specially desired to secure an early evacuation, one ounce of Epsom salts may be added to each enema of salt solution from the time of the operation until the bowels are moved. Epsom salts given by the bowel has a certain purgative value, although much less than when administered by the mouth. If nausea is present, so that the stomach will not tolerate the administration of salines, the use of calomel may be continued until five or even ten grains are given. In such cases it is wise at times to substitute pills for the salines, such as pill. cascara cathartic comp., or pill. aloin, strychnin, and belladonna. In certain cases soft flexible capsules containing half a dram of castor oil are useful; in others, the smaller capsules, containing ten minims of castor oil with a minute dose of croton oil, may be employed. When active peristalsis of the bowels has been secured, the action of the purgative may be hastened by the administration of an enema. A large simple enema containing turpentine, one to four drams, is often sufficient. A more efficient enema, which I have called a "purgative enema," has the following formula:

R.	Magnesii sulph.....	℥ij
	Glycerin.....	℥ij
	Ol. terebinth.....	℥ss
	Aquæ.....	℥iv-vij
M.		

This formula I have used with great satisfaction. If these measures fail to secure an evacuation, the colon may be irrigated. For this purpose two quarts of normal salt solution containing four drams of ox-gall and one dram, more or less, of turpentine, should be slowly introduced into the colon until, if possible, the entire two quarts has been introduced. An enema consisting of one dram of alum to the pint is often serviceable when other enemas fail. These measures will secure an evacuation of the bowels on the third day, as a rule, unless paresis from peritonitis is present.

The hypodermic use of strychnin and digitalis may be discontinued on the second or third day. In certain cases it is wise to continue this hypodermic medication longer, and in other cases these drugs may be given by the mouth. After the bowels have moved, if nausea is absent, liquids may be given freely by the mouth and the enemas of salt solution may be discontinued. Liquid food, such as broths, beef juice, milk, malted milk, tea, coffee, orange juice, and albumin water, may be given in increasing quantities, and by the fourth day the patient can take as much of such foods as the appetite craves. If the bowels have been well cleared out on the third day, they may be moved on the fourth day either with a simple or with a purgative enema. Thereafter they should be moved daily, or at least every

other day. It is a useful general rule to move them one day with purgatives and the next day with an enema. Such drugs as pill. cascara cathartica comp., pill. aloin, strychnin, and belladonna, and pill. aloes and myrrh, are eligible preparations. One of these pills may be given every three hours as required. If the tongue is furred, calomel in fractional doses, followed by a saline, is indicated. If the patient is much disturbed with flatulent colic, nothing is better than a dose of castor oil.

The comfort of the patient is greatly promoted by a daily sponge with either warm or cold water, or with alcohol, followed by the thorough drying of the parts bathed. Careful attention to the patient's clothing and to the bed-linen also is advisable. The abdominal bandage should be readjusted as often as it becomes rumpled or creased, and care should be taken that the abdominal dressing does not become displaced.

On the fifth or sixth day simple solid food may be allowed, such as bread, toast, cornstarch, junket, gelatin, and eggs, soft-boiled or poached. At the end of a week the more digestible vegetables may be added unless flatulency is a symptom. It is best not to put the patient upon a meat diet until the appetite craves it. The simpler foods agree much better with patients until the appetite is thoroughly re-established. When digestion is impaired, the administration of pepsin and hydrochloric acid, or of caroid, is useful. The latter is especially valuable as assisting in the digestion of milk. Milk frequently agrees well with the patient if two or three grains of caroid is taken with each glass of milk, which otherwise causes flatulency and discomfort.

The Removal of Sutures.—It is well to inspect the sutures on the sixth or seventh day. If the wound has been closed by the tier method, using fine catgut for the intracuticular suture, this will be absorbed or nearly so on the sixth day, and can be removed by slight traction. Occasionally it is necessary to cut the suture after drawing it out half an inch or more. When this has been done, the remaining portion of the suture is absorbed. If interrupted through-and-through nonabsorbable sutures are used, those should be removed around which there is evidence of irritation, as shown by redness or swelling. When through-and-through sutures are used it is desirable that they should not be removed before the eighth or tenth day, unless to prevent suppuration. After the sutures have been removed the region of the wound should be washed with bichlorid solution (1 : 2000) and a fresh dressing should be applied and secured in place by adhesive strips. Custom sanctions the use of sterile powdered boric acid dusted over the wound before the application of the dressing. It is harmless, but probably of but little value. Should all the sutures not be removed at one dressing, the same process is to be repeated when the remaining sutures are removed.

On the tenth day the patient may be permitted to sit up in bed on a bed-rest, to break the monotony of lying in bed. At the end of three weeks she may be permitted to sit out of bed for half an hour or an hour. This interval may be increased in accordance with the patient's strength. Hospital patients may be discharged, as

a rule, at the end of four weeks. A shorter stay in the hospital is undesirable. Wounds do not heal solidly in less than eight or ten weeks, and the longer the patient is confined to bed the less is the likelihood of subsequent hernia. A relatively long confinement to bed is also useful in favoring the absorption of inflammatory exudate which may have followed the operation, and in this way lessening the chances of subsequent trouble from adhesions, or from the breaking-down of the exudate. The enforced rest cure is also of great value in restoring the tone of the nervous system in broken-down patients.

At the present time various surgeons are advocating the plan of having patients leave their beds in a few days—some as early as four or five days, and others as early as ten days. They allege that the short confinement to bed does not cause the debility which results from a stay in bed of two or three weeks. It is my belief that this is a bad plan and will be abandoned because of its ill consequences. It is negatively bad because many patients, especially gynecologic patients suffering from septic disease, require long rest in bed and forced feeding to improve their nutrition and to enable their nervous system to regain its tone; and it is positively bad because it must predispose to the occurrence of hernia and to a large percentage of cases of wound suppuration. It is also bad because certain of the later complications of operations will occur after the patient has left the surgeon's care, such as phlebitis, late suppuration in the wound, cystitis, etc., which should be cured before the patient is discharged.

The Use of the Catheter.—Patients should be encouraged to void their urine. Experience has demonstrated that it is impossible to prevent infection of the bladder in a not inconsiderable percentage of cases if the catheter is employed. The liability to cystitis increases with the length of time the catheter is used. If the patient is unable to void her urine, the use of a hot vaginal douche or a hot pack applied over the vulva or pubes is to be recommended unless contraindicated by the patient's condition. The administration of sweet spirits of niter, and also of strychnin, digitalis, and ergotin, is to be recommended when not contraindicated. When catheterization is necessary, the prescribed rules should be observed.

The Pulse.—The character and rapidity of the pulse after abdominal section vary greatly. Feeble patients having severe operations, especially those accompanied by loss of blood or by difficulties with the administration of ether, particularly the persistence of cyanosis or bronchorrhea, have a rapid pulse at the conclusion of operation, varying from 130 to 160. In the absence of complications this rapid pulse-rate drops promptly to 100 or less. Patients in good physical condition having uncomplicated operations may have the pulse-rate slightly, if at all, accelerated. The character and rapidity of the pulse constitute one of the best diagnostic and prognostic signs during convalescence. A pulse under 110, of good quality, is a most reassuring sign, even in the presence of other unfavorable symptoms, as rise of temperature, vomiting, or tympany. On the other hand, a rapid pulse of 120 or more is of grave import, especially if accompanied by tympany, nausea, or rise of temperature. The pulse-rate in cases that are doing well varies from 80 to 100.

Temperature.—At the conclusion of an operation the temperature is usually normal or subnormal. When shock is marked, it may be reduced one, two, or more degrees. When the reduction is extreme it calls for vigorous stimulation and the application of external heat. Stimulants administered hypodermically, such as strychnin, whisky, digitalis, camphorated oil, caffein, and by the bowel, such as whisky and black coffee, are indicated. When reaction is established the temperature rises to normal, or slightly higher, seldom exceeding 100° F. during the first day. On the night of the second day the temperature usually reaches 100.6° F., and in nervous patients 101.2° F. This rise is due to the absorption of fibrin ferment, of wound secretions, or to purely nervous causes. In uncomplicated cases the temperature promptly falls below 100° F. A persistent rise of temperature indicates local inflammation or septic processes. A rise of temperature at the end of a week is sometimes due to inflammation in the abdominal wound, and at other times to suppuration of pelvic exudate. A rise of temperature in the third week is frequently due to phlebitis.

Fever is relatively of greater value as a diagnostic than as a prognostic sign after abdominal section. From the standpoint of prognosis it is of value especially in connection with the pulse-rate, the general aspect of the patient, and the condition of the gastro-intestinal tract.

The Abdominal Bandage.—It has been customary in the past to advise patients to wear an abdominal bandage for a year after operation. In thin patients with firm abdominal muscles it is doubtful if it has value beyond that of reminding the patient of the operation and of the importance of avoiding heavy lifting, straining, and violent exertion. In stout patients and those having a protuberant abdomen from relaxation of the abdominal muscles it has value in that it takes strain off the cicatrix by supporting the abdominal wall and contents. Its chief usefulness is during the first ten weeks, at the end of which time the wound is well consolidated. The use of a well-fitting bandage is to be recommended to those having a protuberant abdomen, and also to those in whom the healing of the wound is not ideal, including all drained cases, and all those in whom the wound has been closed by a single row of sutures.

The Care of the Patient after the Immediate Convalescence.—Intelligent care of the patient until complete restoration to health has been accomplished is most important. Patients are prone to resume their usual duties at an early period. This is unobjectionable when the general health and the nervous tone have not suffered from the local disease, but the reverse is true when the patient has been an invalid for months, with depraved nutrition, habits of invalidism, and loss of nervous equilibrium. This is even more true of such patients when the operation induces the artificial menopause. For such patients prolonged rest, tonics, forced feeding, travel, and in the more marked cases the rest cure, are necessary to restore them to health. Judicious advice and information along these lines will prevent much disappointment on the part of patients and greatly facilitate their recovery.

Shock.—The treatment of shock is much the same whether it be due to hemorrhage or to the combined influence of traumatism, chilling of the body, the influence of the anesthetic, or other causes. When due to hemorrhage, the primary indication is to supply to the circulation fluid to take the place of that which has been lost. This can be done most conveniently by hypodermoclysis, using normal salt solution. The same treatment is almost equally efficacious for shock when not due to hemorrhage. In women salt solution is most conveniently introduced into the cellular tissue of the retromammary spaces. The apparatus necessary is extremely simple (Fig. 272). It consists of a funnel, six feet of rubber tubing, and a large hollow needle, which should not be too sharp. Time is saved by using two needles, which can be attached to the tubing from the funnel by the use of two pieces of rubber tubing and a Y-shaped glass connection. This apparatus should be sterilized by boiling immediately before it is used. Sterile salt solution at a temperature of 100° to 105° F. should be poured into the funnel, which is elevated sufficiently to enable the solution to run through the apparatus. The tube is then pinched, so that the apparatus remains filled with fluid. The solution is introduced by first grasping the breast and lifting it upward and outward, so as to draw it away from the chest. The needle is then inserted at the lower margin of the breast and guided into the retromammary space. Before this is done the skin of both breasts should be disinfected with ether, alcohol, and bichlorid of mercury solution. As a rule, about a pint of salt solution can be introduced into

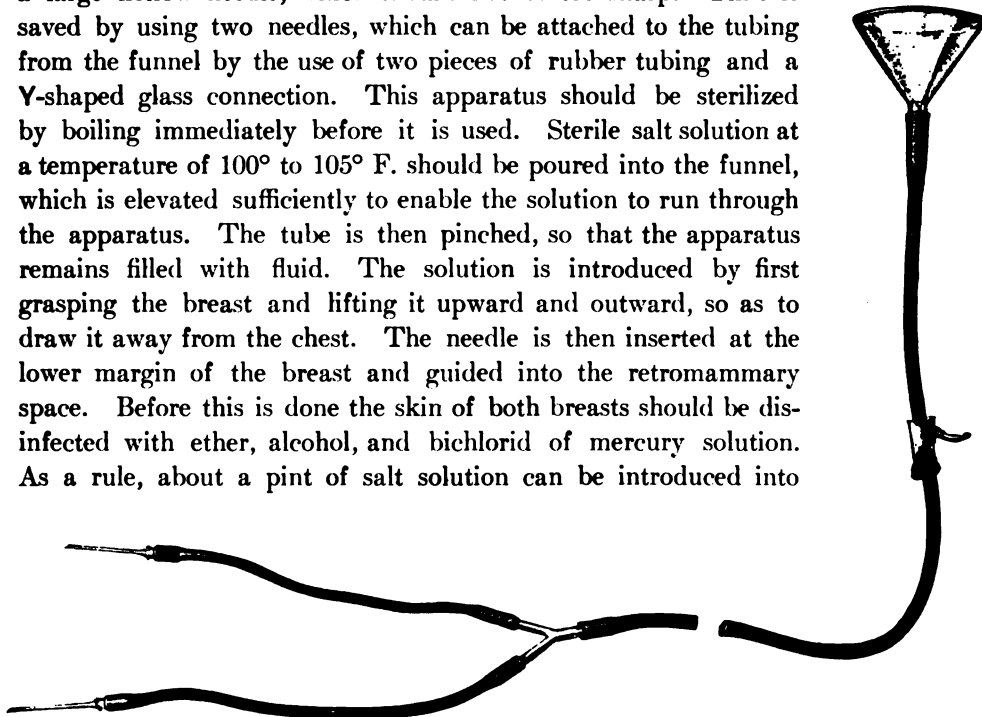


FIG. 272.—NOBLE'S APPARATUS FOR HYPODERMOCLYSIS.

each retromammary space. The fluid will run in more or less rapidly, depending on the elevation of the funnel. The rapid introduction of the solution is to be deprecated, as it sometimes leads to traumatic inflammation from the overstretching of the connective-tissue spaces. When the needle is withdrawn, the opening should be covered with a pad of absorbent cotton held in place by adhesive plaster. Other regions which may be utilized for the introduction of salt solution are the axilla, the retroscapular space, and the buttock. When shock is extreme, the pulse very rapid and small, and the danger of death from heart failure is urgent, a more pronounced influence may be secured by intravenous transfusion. The median, basilic, or any convenient vein may be selected for this purpose. A bandage

should be applied to the arm moderately tight, so as to facilitate the filling of the vein with venous blood. In the more extreme cases this is useless, as the circulation is too feeble to bring it about. After the disinfection of the skin an incision should be made down to the vein, which should be exposed and elevated. The vein should be incised longitudinally for the introduction of the cannula. The apparatus for intravenous transfusion is the same as that described, except that a cannula is substituted for a hollow needle. This should be introduced carefully into the vein. Care should also be taken that all air has been forced out of the apparatus by allowing the salt solution to run through it before introducing the cannula. The salt solution should be introduced slowly, watching the effect upon the pulse, until about a quart has been introduced into the circulation. The effect on the circulation is usually marked, the pulse becoming fuller and less rapid. Occasionally, intravenous transfusion is followed by nervous symptoms, usually in the form of a marked rigor—a symptom which is not observed after hypodermoclysis. When sufficient solution has been introduced, the cannula is withdrawn. The vein should then be ligated above and below the incision, the wound closed, and a suitable dressing applied.

THE SPECIAL MANAGEMENT OF PATIENTS IN WHOM THE ABDOMEN HAS BEEN DRAINED.

The Glass Tube.—The general principles which control the use or avoidance of drainage have been considered elsewhere. When the glass tube has been used alone as a means of drainage after abdominal section, it should receive the following care: If a tube has been selected which does not project beyond the abdominal wall more than half an inch at the original dressing, it is surrounded with the usual gauze dressing applied to the abdominal wound. A layer of cotton is then applied over the gauze. A piece of rubber dam about one foot square, perforated in the center, is applied over the collar at the orifice of the tube. A strip of sterile gauze is inserted to the bottom of the tube itself. A small pad of cotton is applied over the mouth of the tube and the rubber dam is pinned over this, so that any discharges may be absorbed and not soil the rest of the dressing. A large layer of cotton is now applied over the abdomen, and over all the Scultetus bandage is adjusted. If the abdomen is well padded and the bandage is not too tightly applied, undue pressure is not made by the intra-abdominal end of the tube upon the intraperitoneal structures, more especially the rectum. On the other hand, if unfortunately a tube which is too long for the particular case has been employed, or if the rectum is infiltrated with inflammatory products, or if the rectum has been damaged during the operation, it is best to allow the tube to project through the bandage so that the rubber dam is outside instead of inside the bandage. In either case it is well to adjust a cradle over the patient to sustain the weight of the bed-clothing. The influence of the tube in causing perforation of the rectum and fecal fistulæ has been debated pro and con by the

opponents and advocates of glass drainage. This accident may be caused by the tube when it rests upon the bowel at a given point for a length of time, even though the bowel be sound. If the tube is rotated at each dressing and slightly elevated, this must be a very rare accident. Perforation of the bowel is usually due to the fact that the bowel is not sound, that it has been damaged during the operation, or that it has been made friable by infiltration with inflammatory exudate, or that perforation occurs as the result of infection and necrosis of the bowel wall.

In the average case the tube should be drained from two to four times in the twenty-four hours. The technic of the care of the drainage-tube should be as

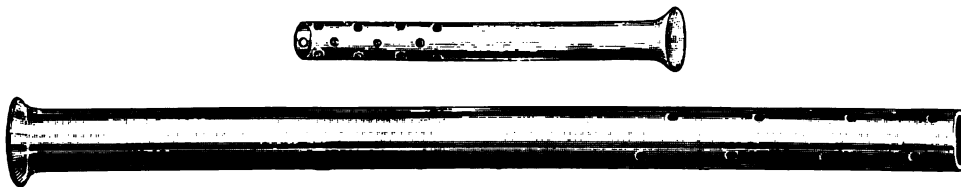


FIG. 273.—GLASS DRAINAGE-TUBES.

rigidly aseptic as that of the operation itself. This applies to the surgeon's hands and to the instruments and dressings employed. The use of sterile rubber gloves is especially to be commended. The tube may be conveniently drained in the following manner: The abdominal bandage is loosened, the superficial cotton dressing is removed, and the pin is removed from the rubber dam. Next the cotton which covers the orifice of the drainage-tube, and then the gauze wicking which fills the drainage-tube, are removed. With a convenient forceps (Fig. 274) a pledget of absorbent cotton is seized and passed to the bottom of the drainage-tube, in this way absorbing any fluid in the lower end of the tube. This process is repeated



FIG. 274.—KELLY'S DRAINAGE-TUBE FORCEPS.

until the fluid is all removed. The tube should be well rotated and slightly elevated at each dressing to prevent the omentum, the appendices epiploicæ, or other structures, from penetrating the lateral openings of the tube; and also to avoid continued pressure of the tube at any one point on the rectum. A strip of sterile gauze previously prepared is then passed to the bottom of the tube. A pad of cotton is replaced over the orifice of the tube, and the rubber dam is again adjusted and pinned. The cotton dressing is readjusted, and the bandage is then reapplied.

It is usually possible to remove the tube in from one to three days. This should be done as soon as the drainage becomes serous in character and is only sufficient in amount to wet one or two pledgets of cotton. When the tube is removed, the opening should be closed by tying a provisional stitch introduced

for this purpose at the time of operation. When the tube has been introduced because of a wound in the bowel which it has not been possible to close satisfactorily, it is best not to remove it before the third day. By this time a wall of lymph has been formed about the tube. If the bowel breaks down after the removal of the tube the discharges will usually find their way to the surface through this channel of lymph.

Certain operators prefer to drain the tube with a suction syringe instead of with cotton and a forceps. They use for this purpose a long-nozzled hard-rubber uterine syringe. A piece of soft-rubber tubing may be slipped over the end of the syringe nozzle, if preferred. A new syringe is employed for each patient. It is thoroughly cleaned after being used, and is kept in bichlorid solution until the tube is again drained. Those advocating this method of draining the tube recommend that it be done very frequently; at first, as often as every half hour, and later, as the discharge decreases, at intervals of two or three hours. Those employing this method, as a rule, do not use gauze wicking.

In cleaning the tube with a forceps and cotton it is desirable at each dressing, after the fluid has been removed, to clean the tube itself with cotton saturated with bichlorid solution 1 : 2000. The bichlorid solution scarcely comes in contact with the peritoneum when used in this way. I am in the habit of using gauze wrung out of bichlorid solution 1 : 2000 as a wicking to fill the tube after the first dressing, instead of merely sterile gauze. The investigations of Robb and Ghriskey¹ have so clearly shown the liability to infection through the tube when asepsis alone is depended upon that the use of germicides is indicated, and, what is fundamentally important, that the use of the glass tube should be restricted.

In my own practice glass drainage is very rarely employed, and when employed it is usually in connection with a gauze drain, more especially in suppurative peritonitis from appendicitis or other cause, in which it is considered easier to drain the pelvis from above.

The Gauze Drain.—The gauze drain at times acts well as a drain and permits fluids to escape by capillary attraction into the abdominal dressings. At other times the gauze becomes impregnated with albuminous material and no longer serves as a capillary drain. As a result, whatever fluids are present collect in the bottom of the pelvis. When the discharges escape freely, the abdominal dressings should be changed at frequent intervals, so as to provide fresh material to absorb the discharges. Care should be taken to keep the wound and the adjacent abdominal wall clean and to attempt its disinfection by washing it with bichlorid solution at each dressing. If the patient is doing well and there is no evidence of the damming back of fluid by the gauze, it is wise to postpone its removal until from three to eight days after the operation. If the gauze be removed too early, the general peritoneal cavity may not be shut off by adhesions, and septic peritonitis may result. As a rule, the earlier the gauze is removed the more difficult

¹ Johns Hopkins Hospital Bull., July, 1891.

and painful is its removal, which is an additional reason for delay. When the removal of the gauze is very painful an anesthetic should be administered.

It is best to remove only a portion of the gauze on any one day. This plan is less painful for the patient and it entails less risk of breaking up the newly formed barrier of adhesions which protects the peritoneal cavity. When all the gauze has been removed, it is well to introduce a strip of gauze entirely through the abdominal wound into the drainage cavity to serve as a tent after the abdominal wound is closed. When this is not done, serum which would escape by capillary attraction along the strip of gauze introduced is liable to become purulent and lead to the formation of an intra-abdominal abscess.

The question as to whether or not the abdominal wound should be closed after the removal of the gauze depends on the conditions present in the particular case. If the opening is a large one, the patient in good condition, and suppuration not present in the drainage tract, the wound should be closed with the exception of a tent. This is done by tying the provisional sutures introduced at the time of operation. On the other hand, if the drainage tract has supplicated, it is much better to leave the wound open, packing it lightly with gauze from time to time until the drainage cavity has become obliterated and the peritoneum entirely shut off. At this stage, if the wound is large, its closure may be hurried by freshening its edges and introducing sutures; if small, it should be treated as a granulating wound until cicatrization is complete.

Owing to the fact that a gauze drain frequently fails to serve the purpose of removing fluids from the pelvis, it is well to introduce a drainage-tube in connection with the gauze whenever there is reason to anticipate free drainage, and especially when the gauze has been used because of a damaged bowel, or because of a freshly suppurative peritonitis. By this combination the gauze serves the purpose of shutting off the general peritoneal cavity from the localized suspicious territory, and the drainage-tube permits of the removal of fluid from the pelvis. By means of the glass tube, after the removal of the gauze, a rubber tube can be inserted and the glass tube removed.

In operations upon the uterus and its appendages, when drainage is required, whenever possible this should be by means of the vagina, an incision being made through the posterior vaginal wall behind the cervix into Douglas' pouch, through which the gauze drain can be removed. By this means the abdominal wound can be closed in the usual way and hernia be avoided. Drainage through the abdominal wound or through both the abdominal wound and vagina is only required in extreme cases of suppurative peritonitis.

How to Remove a Gauze Drain.—The facility with which a gauze drain may be removed depends, in theory, upon the manner in which it is introduced. Gauze may be rolled loosely after the manner of rolling a roller bandage, and the inner end left out of the abdominal opening. When this end is pulled upon the inner layers of gauze are first removed and the portion in immediate contact with the tissues comes out last. In practice the gauze is apt to become tangled, in which

case it is necessary to remove it more or less *en masse*. A satisfactory method is to use a roller bandage of gauze in successive folds, one end of the fold reaching the bottom of the cavity to be drained, the other protruding from the abdominal wound. When strips of gauze have been introduced, the inner strips should be removed first whenever possible, leaving those in contact with the tissues to be removed last. This also is often impossible because the strips become tangled, necessitating the removal of all together. The various strips may be pulled on in turn to loosen the gauze, and this may be promoted by moistening the gauze with sterile salt solution, and if very adherent, by adding dilute hydrogen peroxid solution 1 : 12. Counterpressure should be applied on the abdominal wall, lest the abdominal wall be elevated by traction and the intra-abdominal adhesions broken up. Patience and gentleness are most important in preventing this accident. The confidence of the patient should also be secured, and she should be urged to restrain the natural tendency to make straining efforts during the removal of the gauze. The patient's efforts at straining may break up intra-abdominal adhesions and even cause extrusion of the intestines or omentum. This accident—the protrusion of the omentum or intestine—is of not infrequent occurrence. It is best guarded against by leaving the gauze, or at least a part of it, *in situ* for from three to five days. When it occurs, the protruded parts must be replaced and a fresh gauze pack introduced. The accident need not be followed by peritonitis. When peritonitis follows, it must be met by reopening the abdomen, cleansing the affected region by gauze sponging, and the insertion of a gauze drain. The removal of the gauze is facilitated if when it is placed in position it is surrounded, at least in part, by rubber tissue, so as to prevent adhesions between the gauze and the viscera.

When the gauze is very adherent and can only be removed with great difficulty and with much suffering to the patient, it is best to administer an anesthetic, preferably nitrous oxid, ethyl chlorid, or chloroform.

CHAPTER XII.

THE CELIOTOMY INCISION.

BY CHARLES P. NOBLE, M.D.

The celiotomy incision is an incision made through the abdominal wall to give access to the peritoneal cavity. Its usual site is in the hypogastrium near the median line, but it may be made through any part of the abdominal wall, the more common incisions being those near the right semilunar line to give access to the vermiform appendix, and below the margin of the ribs upon the right side to give access to the liver and gall-bladder region.

The celiotomy incision is called for in all cases in which it is necessary to open the abdominal cavity for operation upon the abdominal contents, and also in those cases in which an exploration is necessary for diagnosis.

Preparation of the Abdominal Wall for Celiotomy.—To secure an aseptic field for the operation the patient should take warm soap and water baths in a bath-tub for at least two days prior to the operation, and special attention should be given to the careful cleansing of the abdominal wall. On the morning of the operation the patient should again take a warm bath, carefully cleansing the abdominal wall with soap and water, after which she should be dressed in clean underclothing, and the special preparation of the abdominal wall carried out after she has returned to bed. The abdominal wall should be very thoroughly cleaned with soap and water and gauze sponges. The hair over the mons veneris and the short hairs over the central portion of the hypogastrium should be shaved. Special care should be taken to cleanse thoroughly the folds about the umbilicus. The abdominal wall should then be scrubbed successively with ether, alcohol, and bichlorid of mercury solution (1 : 1000). At this stage of the preparation the nurse's hands should be sterilized, and pieces of sterile gauze should be employed with which to apply the various solutions. A towel should now be soaked in bichlorid of mercury solution (1 : 1000) and applied moist over the abdomen. This dressing should be held in place by a Scultetus bandage until the patient is transferred to the operating table.

When the celiotomy incision is to be made in some other region than the hypogastrium, the special preparation addressed to the hypogastrium is omitted, and this attention is paid to the region in question.

It is the custom of some surgeons, following the practice of McBurney, to apply a poultice of soft soap on the evening previous to the operation, and to allow it to remain on until the following morning. The purpose of this poultice is to macerate

the epithelium and to facilitate the disinfection of the field of operation. There is no evidence that the results secured by this method are better than by the one already detailed, and as the presence of the poultice is a source of some local discomfort and of more mental uneasiness to the patient, it may be omitted; unless in a given case, when the field of operation is known to be specially dirty, it may be employed as an extra means of cleansing. Care should be taken not to wound or irritate the skin, as there is reason to believe that too vigorous efforts at the mechanical cleansing of the skin promote the occurrence of infection.

The anesthetized patient having been transferred to the operating table, and the bandage and dressing having been removed, an assistant whose hands have been previously sterilized should again wash the abdominal wall with ether, alcohol, and bichlorid solution. This process may very well be preceded by cleansing with soap and water. Sterile towels or other coverings should be applied adjacent to the field of operation. In emergency cases, or when the surgeon has reason to distrust the thoroughness of the preliminary cleansing and disinfection of the abdominal wall, it is well to go through all the steps of the process after the patient is upon the operating table. In this case the assistant should use sterilized gauze sponges and tincture of green soap for the scrubbing process prior to the usual preparation which has been described. This cleansing and disinfection of the field of operation should be very carefully and thoroughly done, because the evidence is positive that the best methods of skin disinfection fail to give absolutely good results. It is well to disinfect the vagina before disinfecting the abdominal wall. This is done by scrubbing the vagina with soap and water followed by free irrigation with sublimate solution. This may be omitted in the case of virgins. This preliminary disinfection of the vagina is imperative in all cases in which vaginal drainage may become necessary.

The median celiotomy incision should be made by rapidly cutting through the skin, subcutaneous fat, and aponeurosis. These layers of the abdominal wall contain no structures of importance which may be injured. The incision should be made slightly to the right of the median line, so that when the aponeurosis is cut through the right rectus muscle will be exposed. The fibers of the rectus muscle should be separated with the handle of the scalpel or with the fingers, rather than divided by the knife. At this stage, if any small vessels are bleeding, they should be seized with artery forceps, the ligation of such small vessels rarely being necessary. The preperitoneal fat should now be divided. This is accomplished by elevating it between two dissecting forceps (or two artery forceps) and incising it with the scalpel. The peritoneum should be incised in the same manner. The peritoneum is elevated before its division to minimize the risk of wounding the bowel (Fig. 275). Care should be taken to seize it lightly with the forceps, lest the underlying bowel or omentum be grasped.

When the operation is done for a tumor which might cause a displacement of the bladder upward, special care is necessary to avoid wounding that viscus. For this reason it is best to open the peritoneum at the upper rather than at the lower

end of the incision. After the peritoneum is opened two fingers should be inserted, the abdominal wall elevated, and the peritoneum divided with blunt-pointed scissors the entire length of the wound.

The length of the incision must vary in different cases. For ventral suspension of the uterus it need not exceed 4 cm. ($1\frac{1}{2}$ in.), whereas in the case of large and solid tumors it may be necessary to make the incision extend from the pubes to the ensiform cartilage. In each case it must be long enough to facilitate the particular operation in hand.

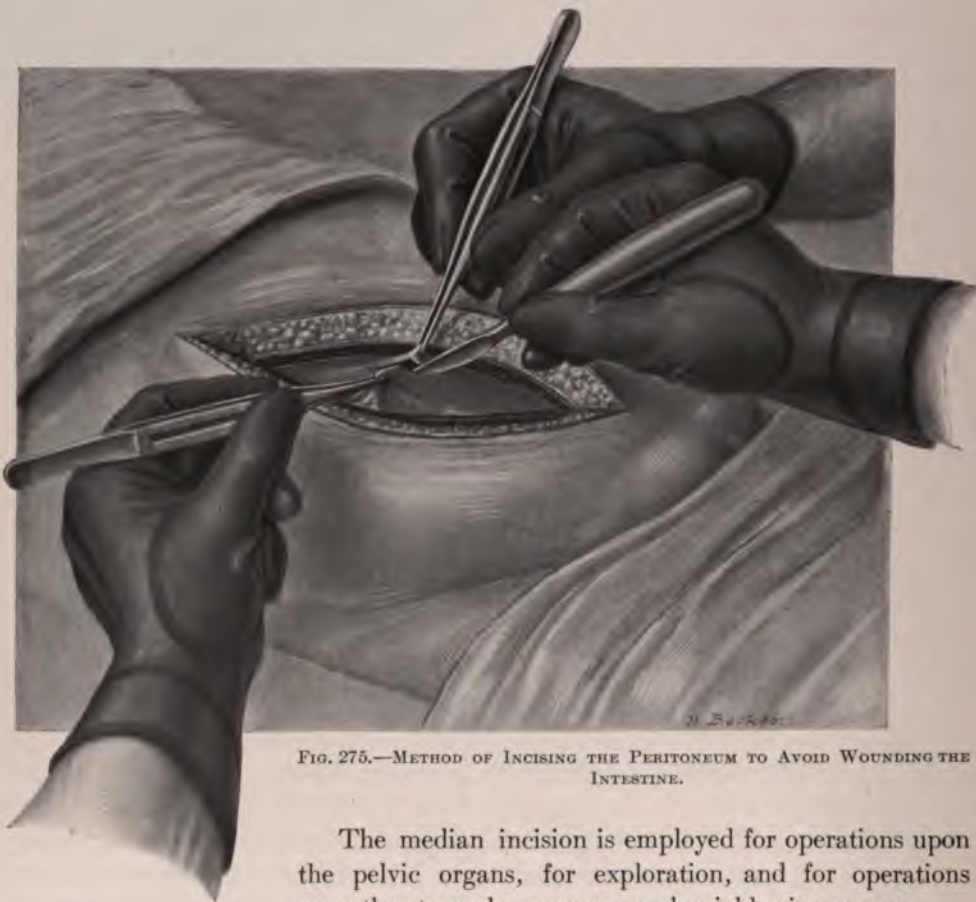


FIG. 275.—METHOD OF INCISING THE PERITONEUM TO AVOID WOUNDING THE INTESTINE.

The median incision is employed for operations upon the pelvic organs, for exploration, and for operations upon the stomach, pancreas, and neighboring organs.

The lateral incision for operations upon the vermiform appendix may be made in several ways. In operations for chronic appendicitis and for those cases in which it is believed that no pus is present, the choice of incision lies between the simple incision, which is best made through the outer border of the right rectus muscle, and McBurney's. Each of these incisions gives ready access to the field of operation and also excellent results in the prevention of post-operative hernia. My own preference is for the simple incision. This is made just within the outer

border of the right rectus muscle, the center of the incision being a line drawn from the umbilicus through the anterior superior spine of the ilium. It is made in the same manner as the median incision. For the average case an incision of 5 cm. (2 in.) is the proper length. This is long enough for convenient work, and may be readily extended if necessary to overcome special difficulties. When sutured by the tier method this incision gives a strong cicatrix. A hernia following this method has never come under my observation (Fig. 276).



FIG. 276.—THE LATERAL INCISION.

McBurney's incision is made parallel to the fibers of the external oblique muscle, and about 2.5 cm. (1 in.) from (within) the anterior superior spine of the ilium. The center of the incision is below a line drawn from the iliac spine to the umbilicus. The skin and subcutaneous fat are incised down to the external oblique, the fibers of which are split and not cut. The edges of the wound in the external oblique are strongly retracted to expose the internal oblique. The fibers of the internal oblique and transversalis muscle are then split and separated and held apart by

retractors. The line of separation through the internal oblique is nearly at right angles to the primary incision. The transversalis fascia and peritoneum are then incised in the same direction as the internal oblique—relatively a transverse incision. The special advantages of this operation lie in the fact that when primary union is obtained the abdominal wall is scarcely, if at all, weakened, and post-operative hernia is practically impossible. The peritoneum and the transversalis fascia are sutured separately with fine catgut. The fibers of the internal oblique and transversalis muscles fall together when the retractors are withdrawn, and the layer needs only a few interrupted catgut sutures. The wound in the external oblique should be sewed with catgut from end to end. The subcutaneous fat should then be sutured with a continuous catgut suture, and the skin closed with

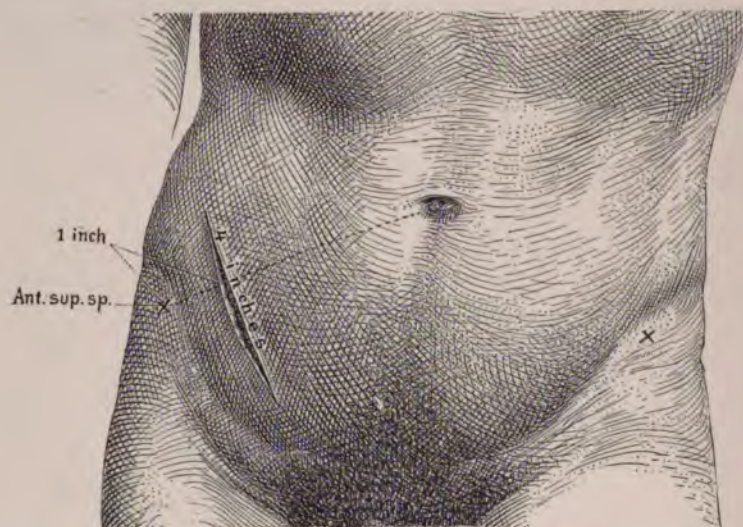


FIG. 277.—McBURNY'S INCISION (1) IN THE SKIN.

the intracuticular suture.¹ McBurney, in a private letter, reports that he has never seen a hernia following this method (Figs. 277, 278, 279, and 280).

Reference should be made to the transverse incisions introduced and practised by Küstner, Pfannenstiel, and Mackenrodt. They resemble each other in having a transverse or semilunar incision through the skin and fat, but differ decidedly in their purpose and applicability in practice.

The advantages of the **Küstner incision**² are purely cosmetic. A semilunar incision, with the concavity above, is made through the fat above the symphysis pubis, following preferably one of the natural folds of the skin. The upper flap is detached from the aponeurosis of the external oblique, and then the usual incision is made

¹ McBurney, Charles: "The Incision Made in the Abdominal Wall for Appendicitis, with the Description of a New Method," *Annals of Surgery*, 1894, vol. xx, p. 38.

² Küstner, O.: "Methodik der gynaekologischen Laparotomie," *Verhandl. d. deutschen Gesellsch. f. Gyn.* 9. Kongr., 1901, Bd. ix, S. 580.

through the aponeurosis, rectus muscle, and peritoneum, parallel to the fibers of the rectus muscle. The incision has the advantage that when healing takes place and the pubic hair grows again, the scar is hidden partly by the natural folds of the skin and partly by the pubic hair. It has the disadvantage of affording less room if the necessities of the operation require a longer vertical incision than is at first anticipated, and that, because of the location of the wound and the greater difficulties of main-

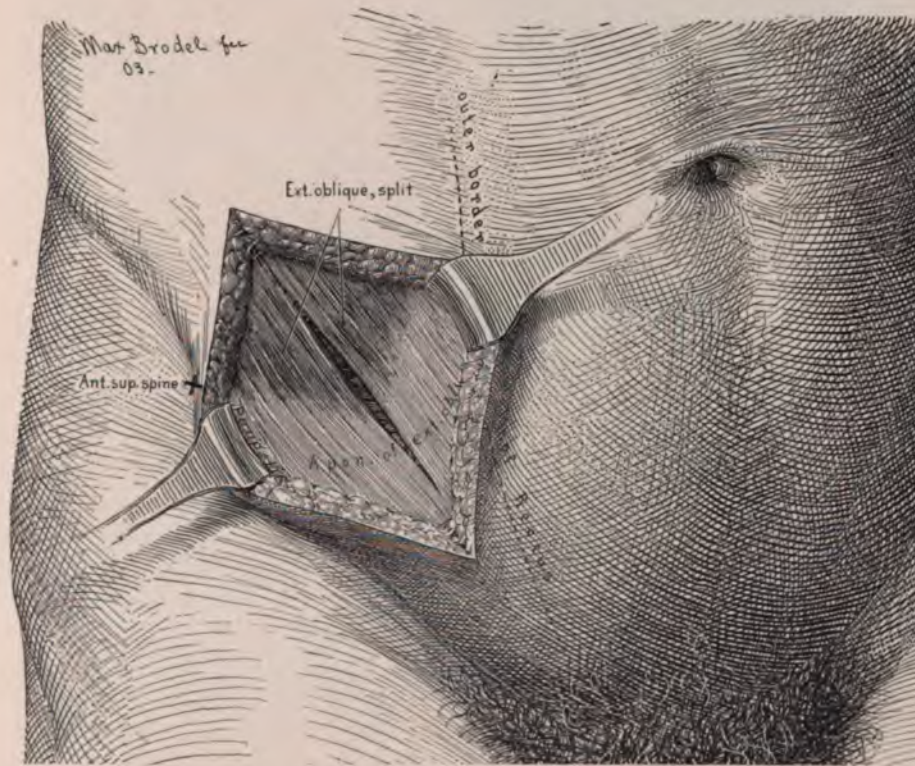


FIG. 278.—McbURNEY'S INCISION (II).

Skin retracted, exposing the external oblique muscle and its aponeurosis; the muscular fibers are only found in the upper half of the exposed area. The division is made in the line indicated by the separation of the fibers in the figure.

taining an occlusive dressing in position, infection and suppuration in the fat are more likely to occur.

The **Pfannenstiel incision**¹ originally was made through the skin and fat, as in the Küstner incision. More recently, and especially in cases in which it is expected that considerable room will be needed, the incision is made at a higher level and more directly transverse instead of semilunar. The incision through the fat

¹ Pfannenstiel, J.: "Ueber die Vortheile des suprasymphysären Fascienquerschnitt für die gynäkologischen Kéliotomien zugleich ein Beitrag zu der Indikationsstellung der Operationswege," Samml. klin. Vortr., Leipzig, 1900, Nr. 268, S. 1735.

and skin is made between the outer borders of the recti muscles. All bleeding vessels in the fat and skin are now carefully ligated. A transverse incision is made through the aponeurosis extending between the outer borders of the recti muscles. The aponeurosis is then detached from the recti muscles both above and below the incision, and all bleeding points are ligated. The recti muscles are now separated and the peritoneum is opened as in the classic median celiotomy incision. The de-

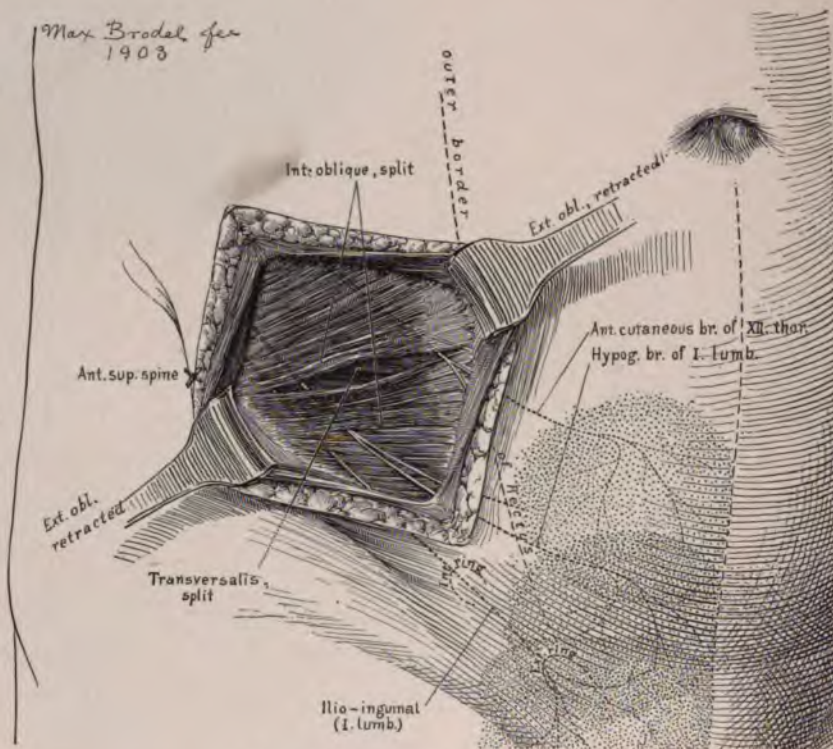


FIG. 279.—McBURNey's INCISION (III).

Showing the skin with the external oblique muscle retracted, and exposing the internal oblique, which is also slightly drawn apart in the direction of the incision about to be made, exposing the transversalis muscle below. The fibers are divided where they are longest. The important point at this stage of the operation is to avoid injury to the nerve-trunks readily found crossing the upper and lower portions of the field. An injury to the muscular or cutaneous branches of the twelfth nerve is followed by muscular paralysis or by an anesthetic area over the zone indicated. Injury to the ilio-hypogastric nerve, seen just above the ilio-inguinal, produces similar disturbances in the lower zones of the rectus and the skin. The arrangement shown is that most commonly found.

tachment of the aponeurosis from the recti muscles must be sufficient to afford the necessary room for the vertical incision. The wound is closed in the following manner: The peritoneum is sutured with a continuous catgut suture. The recti muscles are sutured with a continuous catgut suture. The aponeurosis is sutured with a continuous catgut suture. The incision through the skin and fat is then closed with interrupted sutures of silkworm-gut. The advantages claimed for this method

of opening the abdomen are: that the upper flap of skin and fat affords a certain protection to the intestines during the operation; that less lateral retraction is required to expose the contents of the pelvis, because of the division of the resisting aponeurosis; and last, but most important, that post-operative hernia is less apt to occur than by the classic incision, the ground for this expectation being that the recti muscles are of positive service in taking tension off the wound through the aponeurosis, whereas in the classic incision they can have no such function. Pfannenstiel

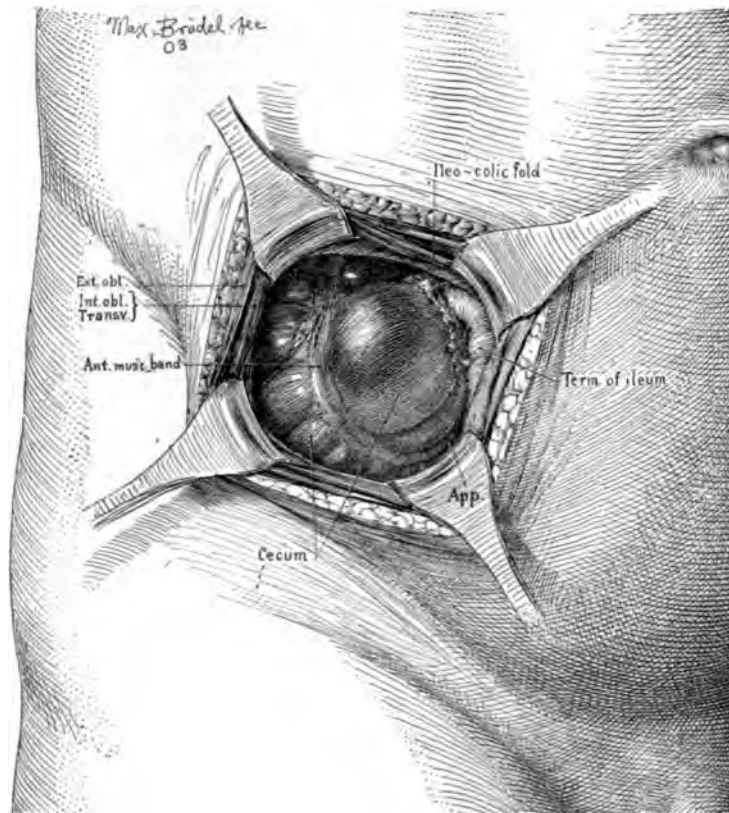


FIG. 280.—McBURNey's INCISION (IV).

Showing the excellent exposure of the cecum and structures adjacent to the appendix. The size and position of the opening can be materially altered to meet changing conditions, such as an abnormally placed appendix, by traction in one or another direction.

claims almost perfect results in the avoidance of hernia. The method affords a good exposure of the pelvic contents for all operations requiring a moderate amount of room. It is not adapted to operations upon large solid tumors.

The **Mackenrodt incision**¹ is employed in the radical operation for cancer of the uterus and is employed because it gives a better access to the field of operation

¹ Mackenrodt, A.: "Die Radikaloperation des Gebärmutter-scheidenkrebses mit Ausräumung des Beckens," Verhandl. d. deutsch. Gesellsch. f. Gyn., 1901, Bd. ix, S. 139.

and shortens the operation by facilitating its various steps. A semilunar incision is made directly through the skin, fat, aponeurosis, recti muscles, and peritoneum. The lowest point of the incision is about 2 cm. above the pubes. In closing the incision the aponeurosis muscle and peritoneum are sutured with interrupted sutures of bronze wire sufficiently fine to tie. The skin and fat are then closed separately by the same method. A gauze drain of the subcutaneous fatty tissue is placed at each end of the incision. There can be no question that Mackenrodt's incision greatly facilitates the operation, as the entire pelvic cavity is accessible, and but little

lateral traction upon the wound is necessary during the operation to expose the field. Upward and lateral traction upon the uterus is also facilitated in exposing the depths of the pelvis for operative manipulation. Mackenrodt claims that but a small percentage of herniæ results. The adoption or rejection of the incision in operating for cancer of the uterus must depend upon the operator's estimate of its advantages in facilitating the operation, as opposed to his estimate of the ultimate damage to the functional integrity of the abdominal wall.

After making the abdominal incision for the purpose of performing a definite operation, it is frequently desirable to explore the abdomen before proceeding with the operation. By this means the condition of the vermiform appendix, the gall-bladder,

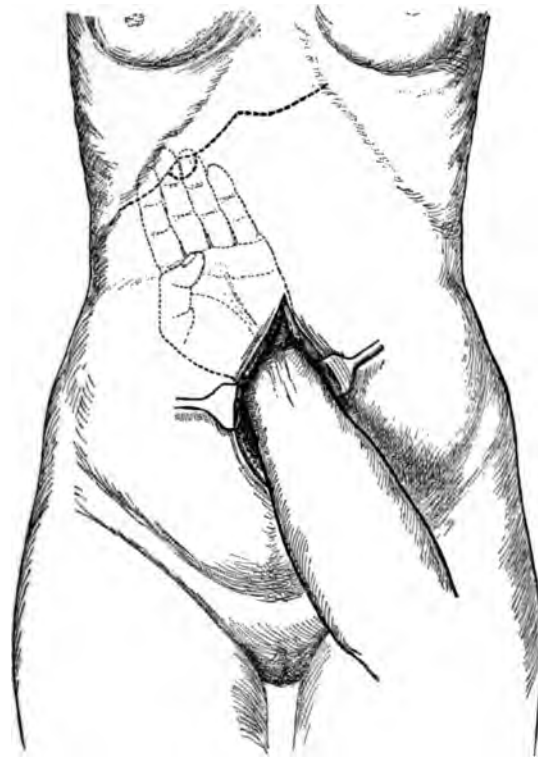


FIG. 281.—EXPLORING THE GALL-BLADDER THROUGH THE ABDOMINAL INCISION (after Kelly).

the kidneys, the stomach, the pancreas, and the spleen can be determined (Fig. 281). Kelly¹ has recommended cutting down upon the gall-bladder in such cases with the hand within the abdomen as a guide (Fig. 282). The same principle has long been employed, more especially in making secondary incisions or stab wounds for the purpose of drainage, most frequently through the loin.

Incisions in other parts of the abdomen are made to meet the necessities of individual cases, and the same principles are followed.

¹ Kelly, H. A. : "The Exploration of the Abdomen as an Adjunct to Every Celiotomy," *Med. News*, Dec. 16, 1899.

CLOSURE OF THE ABDOMINAL INCISION.

The Through-and-through Suture.—The classic method of closing the abdominal incision is to use a single row of through-and-through interrupted sutures to close all the layers of the abdominal wall. This method is the simplest and can be carried out most quickly, and were its results in the primary union of the wound and in the prevention of post-operative hernia as good as those of other methods, it would be universally employed. Many surgeons from experience with it have become convinced that a higher percentage of suppuration and a much higher percentage of post-operative herniæ follow this method of closing the abdominal wound than that of closing the various layers of the abdominal wall separately. Under definite circum-

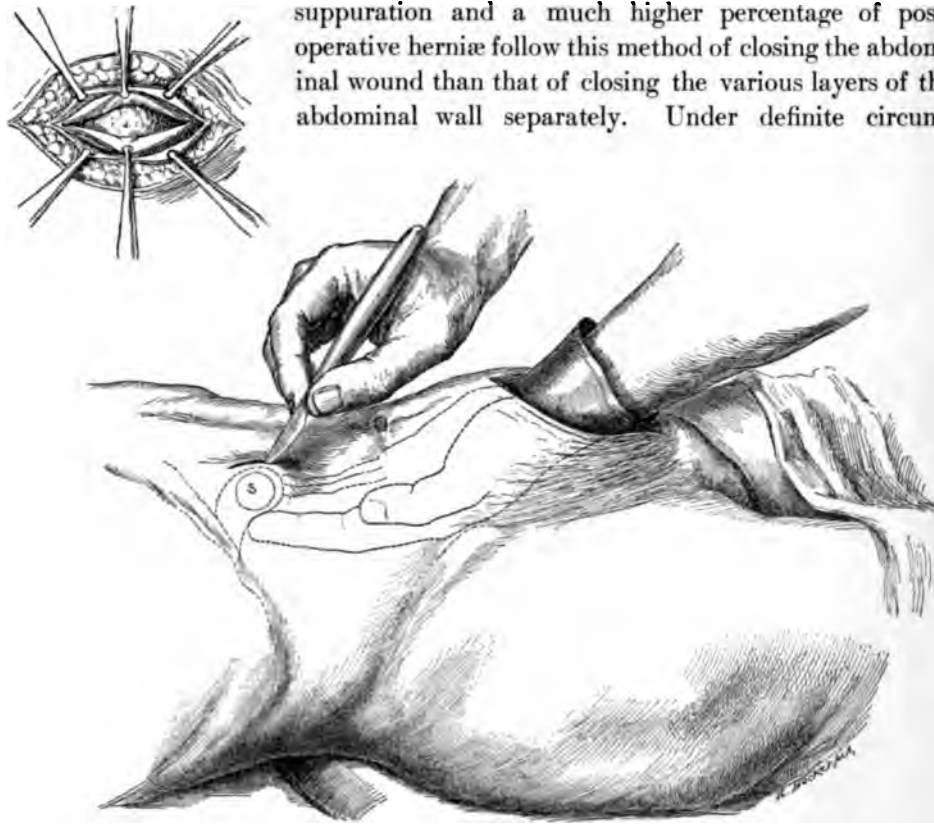


FIG. 282.—INCISING THE ABDOMEN OVER THE GALL-BLADDER WITH THE INTRA-ABDOMINAL HAND ACTING AS A GUIDE AND PROTECTION.

a, Exposing the gall-bladder.

stances the through-and-through suture should always be employed (1) whenever the condition of the patient, owing to feebleness before operation or evidences of shock during the operation, indicates the necessity for haste; (2) whenever it is necessary to employ drainage, especially gauze drainage; (3) when there is reason to expect suppuration in the wound, as, for example, when the surgeon is obliged to operate through a region upon which a blister has recently been employed.

Silkworm-gut or silver wire is the best material for through-and-through sutures. The needle should be introduced into the skin near the margin of the wound, and should describe an arc of a circle when passing through the tissues of the abdominal

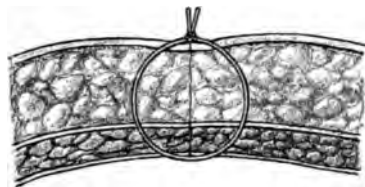


FIG. 283.—CORRECT METHOD OF PASSING THE THROUGH-AND-THROUGH SUTURE. The suture forms a circle when tied. Homologous structures are in apposition.

wall, emerging through the peritoneum at a point to correspond with the point of entrance (Fig. 283). The needle should penetrate the opposite side of the wound in the reverse way. When the suture is introduced after this method, when tied, it tends to bring the cut surface of the wound naturally into apposition, uniform pressure being made upon the wound at every plane, the special object being to bring the cut edges of the aponeurosis into apposition. The sutures should be introduced about 9 mm. ($\frac{3}{8}$ in.) apart. When tying

them care should be exercised to bring the edges of the wound snugly together without causing undue tension. By this method the various layers of the abdominal wall will be more or less perfectly approximated, depending upon the accuracy of the suturing, the thickness of the abdominal wall, and the amount of tension in the abdominal wall at the time the sutures are tied. Very far from perfect results are secured in fat women and in those patients in whom the abdominal wall is tense (Fig. 284).

When gauze drainage is employed, hernia will result in practically all cases. When a glass drainage-tube is employed, hernia will result in from 5 to 10 per cent. of cases. When drainage is not employed, hernia will result in probably 5 per cent. of the cases, being most apt to occur in fat women and in those in whom infection and suppuration in the wound take place. The papers of Winter¹ and La Torre² show that these statements are conservative as applied to European practice, and my observations warrant them as applied to conditions in America.³

The Tier Suture.—The percentage of cases in which suppuration and hernia follow when the through-and-through suture is employed has led surgeons to seek for a better method of closing the abdominal wound. The object of suturing a wound is to hold its component parts in apposition, so that the normal anatomic condition may be restored by the healing process. This fact suggested the suturing of the various layers of the abdominal wound by separate rows of sutures, and gave rise to the so-called tier suture for closing wounds. The advantage of the method

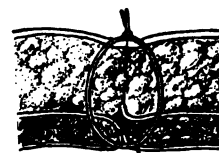


FIG. 284.—INCORRECT METHOD.

The suture is passed nearly parallel to the edges of the incision. It acts as a "drawing string." The edges of the aponeurosis are not in apposition.

¹ Winter, George: "Bauchnaht und Bauchhernie," Verh. d. Deutsch. Gesell. f. Gynäk., 1895, Bd. vi, S. 577.

² La Torre, Felice: "Quel est le Meilleur Mode de Fermeture de l'Abdomen?" Trans. Internat. Congress of Gyn. and Obstet., 1896, vol. ii, p. 11.

³ Bantock, G. Granville: "What is the Best Method of Closing the Abdomen?" etc., Trans. Internat. Congress of Gyn. and Obstet., 1896, vol. ii, p. 3.

is that the surgeon is enabled to secure the apposition of the various layers of the wound in their anatomic relations.

The following is the method which I employ:¹ The peritoneum is closed with a continuous No. 1 cumol catgut suture (Fig. 285). The wound is then carefully cleansed with salt solution, and all bleeding is arrested by pressure forceps or by ligature with fine catgut. The aponeurosis of the transverse muscles upon one side is separated by blunt dissection from the rectus muscle, and upon the opposite side the fat is dissected off from the aponeurosis. A needle armed with medium (No. 2 or No. 3) chromicized cumol catgut² transfixes the aponeurosis and muscle at the lower end of the wound, and then by continuous suture the rectus muscle is closed. The peritoneum is caught up by the needle at several points so as to prevent the formation of a dead space between the muscle and peritoneum (Fig. 286). When the upper end of the wound is reached the needle is brought out through the aponeurosis, and then by continuous suture the under surface of one aponeurosis is sutured upon the upper surface of the opposite aponeurosis. Only one knot is required. This should be made with a triple rather than with a double tie.³ By this method of suturing one aponeurosis is sutured upon the other as the flap of an envelope is pasted down. The continuous suture of the aponeurosis should be reinforced by one or more mattress sutures to take the strain off the continuous suture.

The subcutaneous fat is closed in one or more layers, depending upon the



FIG. 285.—THE TIER SUTURE.

The peritoneum is closed with a continuous suture. The fat is separated from the aponeurosis on the left side of the wound. The aponeurosis is detached from the muscle on the right side of the wound.

¹ Noble, Charles P.: "Overlapping the Aponeuroses in the Closure of Wounds of the Abdominal Wall," *Ann. of Surgery*, March, 1906.

² Chromicized catgut, sterilized by the cumol method, is not absorbed for six weeks.

³ Noble, Chas. P.: "Remarks on the Influence of Technique upon the Results of Closure of Wounds of the Abdominal Wall," *Boston Med. and Surg. Jour.*, Mar. 8, 1900, p. 237.

thickness of the fatty layer, No. 1 cumol catgut being used. It is important to suture the fatty layer carefully, as otherwise a dead space is left in which blood may collect and lead to suppuration. The skin is closed with an intracuticular

suture, using No. 1 cumol catgut (Fig. 287).

This method is an adaptation of that which I employed when using buried silkworm-gut sutures,¹ and was suggested by my own experience with the use of buried permanent sutures, and by the work of Edebohls.² This method of closing the abdomen will reduce the occurrence of post-operative hernia to a small fraction of one per cent.

Several other methods of closing the abdominal wound have prominent advocates. The simplest modification of the classic method is, after the introduction of the through-and-through interrupted sutures, to suture the aponeurosis with a continuous catgut suture before tying the interrupted sutures. This is done to insure the accurate coaptation of the aponeurosis. In applying this method care should be taken to have the interrupted sutures well drawn through the lips of the wound and the wound itself as closely in apposition as feasible. The objection to the method is the possibility of including a loop of bowel in one of the interrupted sutures and strangulating the bowel when the suture is tied after



FIG. 286.—THE TIER SUTURE.

The rectus muscle is sutured. The aponeurosis is being overlapped with a continuous suture.

the closure of the aponeurosis. This objection is theoretic, as no such case has been reported.

Another method of closing the abdominal wound is to close the peritoneum with a continuous catgut suture, then to introduce interrupted sutures including

¹ Noble, C. P.: "A New Method of Suturing the Abdominal Wall in Celiotomy," *Amer. Jour. Obstet.*, 1897, vol. xxxv, No. 4, p. 507.

² Edebohls, George M.: "The Prevention of Hernia after Incision of the Abdominal Walls," *Amer. Gyn. and Obstet. Jour.*, Jan., 1893, vol. iii, p. 24. *Ibid.*: "What is the Best Method of Making and Closing the Celiotomy Incision?" *Amer. Gyn. and Obstet. Jour.*, May, 1896, vol. viii, p. 561.

skin, subcutaneous fat, aponeurosis, and muscle. Before these are tied the aponeurosis may or may not be closed with a continuous catgut suture. This method avoids the possibility of strangulating the bowel by its inclusion in a suture.

When the classic method of closing the wound is employed, it is well to have each alternate suture include only the skin, subcutaneous fat, and aponeurosis. This modification of the classic method increases the probability of securing accurate coaptation of the aponeurosis.

The method of using buried permanent sutures was largely employed some years ago. Silver wire was first used systematically by Schede,¹ in 1887, as a buried suture in closing the abdominal incision, and later it was largely employed in the surgical and in the gynecologic services in the Johns Hopkins Hospital under Halsted and Kelly. In 1892 Edebohls began the systematic use of silkworm-gut as a buried suture, and I adopted the method in the same year.² The method was largely tried by surgeons, and the consensus of opinion is that the permanent buried suture is not superior to the absorbable suture, and its general use has been abandoned. Various surgeons reported as much as 10 per cent. of suppurations with the method, which led to the infection of the sutures and required their removal. My own experience with silkworm-gut as a buried suture embraced 472 cases, of which



FIG. 287.—INTRODUCING THE INTRACUTICULAR SUTURE.
Excepting thin subjects, the fatty layer should be sutured before closing the skin wound.

10 supplicated, or 2 per cent. There were 2 post-operative herniæ—1 in the cases which supplicated, or 10 per cent., and 1 in the 462 cases in which primary union was obtained, or about one-fifth of 1 per cent. In none of the cases in which primary union occurred has it been necessary to remove a suture from a delayed

¹Schede, M.: "Ueber den Gebrauch der versenkten Drahtnaht bei Laparotomien und bei Unterleibsbrüchen," Festschrift zur Feier der 70. Geburtstages Friedrich v. Esmarch, Jan. 9, 1893.

²Noble, Charles P.: "Remarks on the Use of the Buried Permanent Suture in Abdominal Surgery," Amer. Gyn. and Obstet. Jour., Dec., 1896, vol. ix, p. 757

suppuration. In spite of this favorable experience I have abandoned the permanent buried suture, and use only catgut to close the abdominal wound.

DRESSINGS.

When the wound is closed the towels or other coverings are removed from the patient, the wound and adjacent surfaces are washed with bichlorid of mercury solution to wash away blood-stains, and the dressing is applied. The dressing consists of gauze wrung out of bichlorid of mercury solution 1 : 2000. Over this is applied a layer of absorbent cotton, and the whole dressing is held in place by several strips of adhesive plaster. Over all is applied a Scultetus bandage. The moist sublimate gauze promotes asepsis of the wound by acting upon any germs which may be present upon the skin surface when the dressing is applied. After several hours the gauze becomes dry and fills the function of dry gauze. Over nine years' experience with this dressing has shown but 2 per cent. of suppurations; the exact fractional percentage varying but slightly from year to year. The only objection to the dressing is that rarely it produces irritation and pustulation in the skin, most commonly in blondes with tender skin. It is very important that the dressing shall be held firmly in place to protect the wound from infection. The adhesive straps should be carefully applied with this object in view, rather than to support the abdominal wall with the straps; hence both the upper and the lower strap should extend beyond the dressing, and fix it firmly to the skin.

Various other forms of dressing are in favor, especially the simple, dry, sterile gauze and silver-foil as employed by Halsted and Kelly. Metallic silver is said to possess positive antiseptic power, and it is on this ground that it is recommended. The moist sublimate gauze is to be preferred, as it possesses the good qualities of the other dressings and is superior to them as a germicide.

CHAPTER XIII.

OPERATIONS FOR RETRODISPLACEMENT AND PROLAPSE OF THE UTERUS.

SHORTENING THE ROUND LIGAMENTS.

BY CHARLES P. NOBLE, M.D.

By shortening the round ligaments of the uterus is meant the shortening of these structures, by any one of various operations, either in the inguinal canals or within the abdomen.

History.—The operation which has been done most frequently in the past is known as the Alexander operation, because it was perfected and popularized by W. Alexander, of Liverpool.¹ The typical Alexander operation is performed by finding the outer end of the round ligament at the external ring, drawing the ligament through the inguinal canal until sufficiently shortened, and then fastening the end. This operation has been modified by others, who have laid open the inguinal canal as a part of the technic. Like most discoveries in medicine, the work of Alexander, while original with himself, was anticipated by the work of others. Alquié, of Montpellier, France, appears to have been the first who conceived the idea of shortening the round ligaments to correct downward and backward displacement of the uterus. He called the operation “utero-inguinoraphie.”² He performed the operation only upon animals and in the dissecting room, never upon a living woman. A commission from the Académie de Médecine, composed of Baudelocque, Bérard, and Villeneuve, was appointed to consider Alquié’s proposal, and condemned it *in toto*. The proposal met with favor from Aran,³ who never carried it into execution.

The first to attempt the operation upon a living woman was Deneffe, in 1864, but it was a complete failure, neither ligament being found.⁴

Alexander’s first operation was performed December 14, 1881. Adams operated first, unsuccessfully, in February, 1882, but he had previously both practised and taught the operation on the cadaver and recommended it to his classes. For these reasons the operation is frequently called the Alquié-Alexander-Adams operation.

The typical Alexander operation, or its modification involving the opening of the inguinal canals, is applicable only to women having normal uterine appen-

¹ Alexander, W.: “A New Method of Treating Inveterate and Troublesome Displacements of the Uterus,” *Med. Times and Gaz.*, London, 1882, i, 327.

² Alquié: “Mémoire sur une nouvelle méthode pour traiter les divers déplacements de la matrice,” *Bull. Acad. de med.*, Paris, 1840–41, Tome vi, p. 223.

³ Aran: “Maladies de l’utérus,” 1858, p. 1039.

⁴ Deneffe: “Raccourcissement des ligaments ronds pour la cure de la retroversion, de la retroflexion, et de la chute de l’utérus,” *Ann. Soc. de Med. de Gand*, 1885, lxiv, pp. 135–138.

dages and having a non-adherent uterus. In the desire to extend the use of the principle of the operation to women with diseased appendages or having adhesions, various intraperitoneal operations have been invented, which are known by the names of their inventors,—Wylie, Dudley, and Mann. These operations consist in suturing the round ligaments to the uterus, or in folding the intra-abdominal portion of the round ligament upon itself in various ways. The general consensus of opinion, is that this type of the operation is a failure, and it has therefore been abandoned. Goldspohn¹ attempted to extend the field of the operation by opening

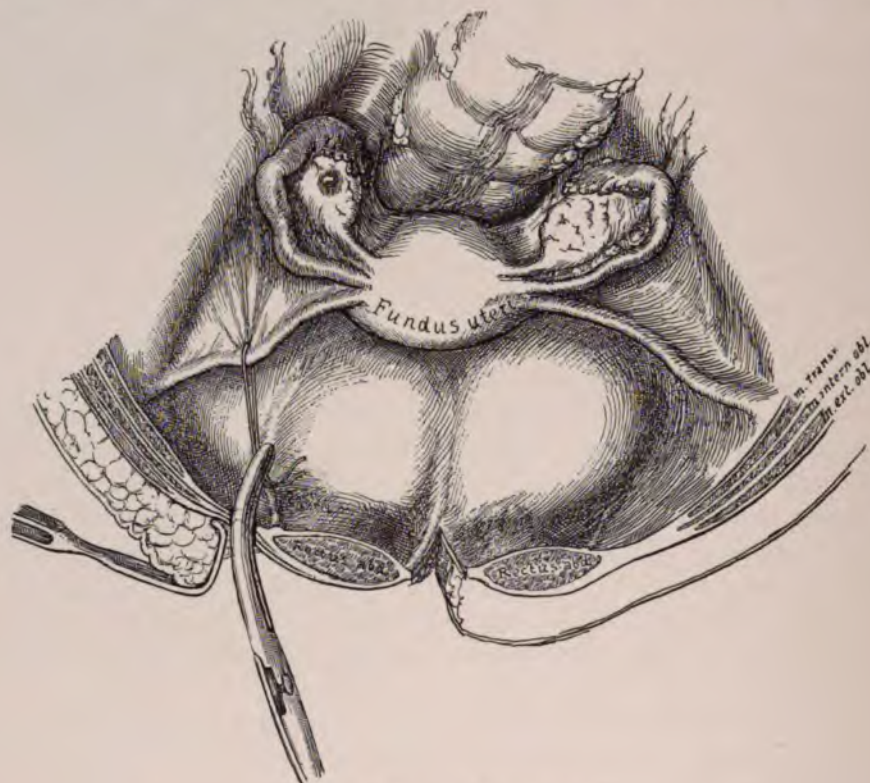


FIG. 288.—GILLIAM'S OPERATION.

Method of drawing round ligaments through the anterior abdominal wall.

the abdominal cavity at each internal ring, performing whatever intraperitoneal operation was indicated, and completing the operation by shortening the round ligaments.

Webster and Baldy² conceived the idea of shortening the round ligament by

¹ Goldspohn, A.: "The Serviceability of the Alexander Operation in Aseptic Adherent Retroversions of the Uterus, when Combined with Liberation of it and Resection and Suspension or Removal of Adnexa through the Dilated Internal Inguinal Ring," *Med. Record*, 1898, vol. liv, p. 509.

² Webster, J. Clarence: "A Satisfactory Operation for Certain Cases of Retroversion of the Uterus," *Jour. Amer. Med. Assoc.*, Oct. 5, 1901. Baldy, J. M.: "Retrodysplacements of the Uterus and Their Treatment," *New York Med. Jour.*, 1903, No. 2, p. 167.

piercing the broad ligament beneath the Fallopian tube, seizing the round ligament and drawing its free portion through the opening in the broad ligament and suturing it to the posterior surface of the uterus at or about the level of the internal os. Both Webster and Baldy report good results from this operation, and it has been done to some extent by others. Upon theoretic grounds it combines all of the bad points of the various operations for retroversion: (1) It depends for its strength upon the poorest portion of the round ligament—that contained within the inguinal canal; (2) it depends for its permanent success upon the formation of intraperitoneal adhesions between the round ligament and the posterior surface of the uterus; (3) it is not anatomic in that it fastens the round ligament behind the uterus and at a point at least 2 cm. below that intended by nature.

Gilliam¹ proposed to shorten the round ligaments by making an abdominal section, separating the fat from the aponeurosis of the external oblique, making an incision through the aponeurosis upon each side of the central incision, passing an instrument directly through the anterior abdominal wall, including the peritoneum, and then seizing the round ligament (or a provisional ligature embracing the round ligament) at a point about two inches distant from the horn of the uterus and then drawing the round ligament through the anterior abdominal wall and suturing it to the aponeurosis of the external oblique.

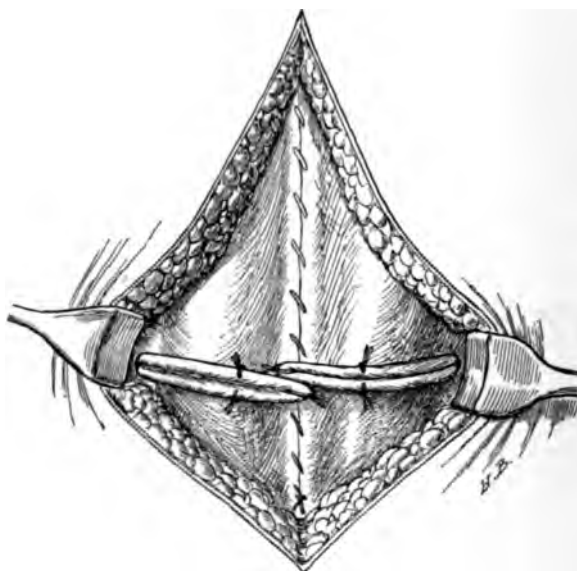


FIG. 289.—GILLIAM'S OPERATION.
Method of fastening the round ligaments external to the aponeurosis.

Gilliam received the suggestion for his operation from Ferguson, who, in 1899, proposed to suspend the uterus by suturing the proximal third of the round ligament to the anterior abdominal wall.² Gilliam's operation has in its favor its simplicity and the fact that the best portion of the round ligament, namely, that next the uterus, is utilized in drawing and holding the uterus forward (Figs. 288, 289). Also, as the ligaments traverse the peritoneal cavity in a straight line from the horns of the uterus to the anterior abdominal wall, this fact gives the ligaments an additional mechanical advantage as a support over the anatomic course of the ligaments, which is that of a curved

¹ Gilliam, D. Tod: "Round-Ligament Ventrosuspension of the Uterus: A New Method," *Amer. Jour. Obstet.*, 1900, vol. xli, No. 3, p. 299.

² Ferguson, Alex. H.: "Preliminary Report of Anterior Transplantation of the Round Ligaments for Displacements of the Uterus," *Jour. Amer. Med. Assoc.*, Nov. 18, 1899, p. 1275.

line. The theoretic objection to Gilliam's operation is that as each round ligament traverses the peritoneal cavity, the anterior portion of the pelvis is divided into three segments, any one of which may act as a pocket in which the bowel may become caught, producing obstruction.

This obvious disadvantage of the Gilliam operation led Simpson, in 1902, to propose the retroperitoneal shortening of the round ligaments, at the meeting of the Southern Surgical and Gynecological Society.¹ At the same meeting Ferguson² and George H. Noble³ read papers describing their methods of shortening the round ligaments by means of abdominal section and fastening the ligaments to the anterior wall of the abdomen.

Since 1902 various men have modified the procedure, which at the present time has a satisfactory technic and good immediate results; but sufficient time has not elapsed to test its merits completely as an alternative to the Alexander operation on the one hand or to suspensio uteri upon the other.

THE EXTRAPERITONEAL SHORTENING OF THE ROUND LIGAMENTS—THE ALEXANDER OPERATION.

The extraperitoneal shortening of the round ligaments is indicated for the cure of retroversion of the uterus in those cases in which the uterine appendages are healthy and in which the uterus is freely movable—in other words, in those cases in which the retroversion of the uterus is not complicated by pelvic peritonitis or its secondary results. It may be performed also in certain cases of prolapse of the uterus in combination with the necessary plastic operations described elsewhere. When performed as one of a series of operations for the cure of prolapse of the uterus, it is most appropriate for the cure of cases of partial prolapse in young women of child-bearing age, because, as will be shown later, it causes no interference with the progress of pregnancy or labor. On the other hand, it is not so satisfactory as either suspension, or ventrofixation of the uterus for cases of complete procidentia; because it does not secure so marked an elevation of the uterus, nor does it afford as good support in preventing a recurrence of the prolapse. Hence, for women who have passed the child-bearing age it is inferior to ventral fixation in cases of procidentia.

For a further consideration of the questions involved, the reader is referred to the chapters upon Ventral Suspension of the Uterus, and Procidentia Uteri. For a consideration of the various problems entering into procidentia uteri, the reader is referred to the chapter on Prolapsus Uteri. For a consideration of the anatomic questions involved, and for the philosophy of the support of the pelvic viscera, the

¹ Simpson, F. F.: "Intraabdominal but Retroperitoneal Shortening and Anterior Fixation of the Round Ligaments for Posterior Uterine Displacements," *Trans. Southern Surg. and Gynec. Soc.*, 1902, vol. xv, p. 223.

² Ferguson, Alex. H.: "Anterior Transplantation of the Round Ligaments for Displacements of the Uterus," *ibid.*, p. 212.

³ Noble, George H.: "Intramural Extraperitoneal Anchorage of the Round Ligament for Posterior Displacement of the Uterus," *ibid.*, p. 217.

reader is referred to the section dealing with the anatomy of the pelvic floor in the chapter on Perineorrhaphy, page 390, and to the chapter on Procidentia Uteri (hernia of the pelvic contents), page 419.

CONDITIONS FOR WHICH THE OPERATIONS MAY BE PERFORMED.

Retroversion and Retroflexion of the Uterus.—By retroversion of the uterus is meant that the uterus as a whole is turned over backward so that the fundus lies in the hollow of the sacrum. The organ still preserves more or less perfectly its normal anterior curvature, which can be made out by bimanual examination or by passing a sound within its cavity.

By retroflexion of the uterus is meant that the uterus as a whole is turned over backward and that, in addition, the body of the uterus is flexed backward upon the cervix, which can be made out by bimanual palpation or by passing a sound within its cavity.

Descensus uteri is associated, as a rule, with both retroversion and retroflexion of the uterus. The descensus is caused by one of several factors. In nulliparæ it may be due to the prolonged action of intra-abdominal pressure, which in cases of retrodisplacement falls upon the fundus itself or upon the anterior wall of the uterus instead of upon the posterior wall, when the uterus occupies its normal position of ante flexion. In other cases the descensus is caused by the action of intra-abdominal pressure in conjunction with the relaxation of the uterosacral ligaments, which no longer afford the normal support to the uterus. In parous women descensus may be caused by subinvolution with relaxation of the uterosacral ligaments and increased weight of the uterus, in addition to intra-abdominal pressure. In other cases it may be caused by the loss of support from the pelvic floor due to lacerations of the perineum.

The **causes of retrodisplacement** of the uterus are various. It may be congenital or developmental. It may be due to the combined influence of constipation with impaction of the rectum, which pushes the cervix forward, to overdistention of the bladder, which pushes the fundus backward, and to intra-abdominal pressure acting continuously, or through the sudden increase of intra-abdominal pressure brought about by active exertion or lifting or falling from a height. There is little doubt that this combination of conditions is the cause of retrodisplacement in a definite proportion of cases. It may be caused by labor, in which the influence of the tight binder, the increased weight of the pregnant uterus, and subinvolution, with or without loss of support due to lacerations of the perineum, are the contributing factors. And it may be due to the pressure of intrapelvic tumors which by their growth displace the uterus backward. Retroversion or retroflexion may also be the result of traction from inflammatory adhesions due to pelvic peritonitis. When inflammatory exudate behind the uterus undergoes organization, the resulting adhesions subsequently undergo contraction and may drag the uterus backward.

The *symptoms* of retroversion and retroflexion depend not only upon the displacement of the uterus, but also upon the complications in the particular case.

It is claimed by some authorities that retrodisplacement *per se* produces no symptoms, and that when symptoms exist they are due to complications. There can be no doubt that the symptoms of uncomplicated retrodisplacement are far less marked than is true of the complicated cases. Women with good general health and having a normal nervous system may suffer little or even not at all from an uncomplicated retroversion; but, on the other hand, uncomplicated retroversion so often causes severe local and general symptoms that this position of the uterus must be regarded as a morbid condition requiring treatment for its cure. Moreover, as a result of retrodisplacement of the uterus, the ovaries are low in the pelvis and tend to become prolapsed, enlarged from pelvic congestion, and eventually to undergo cystic degeneration or cirrhotic changes as a result of their malposition and passive congestion.

The claim that uncomplicated retrodisplacement of the uterus does not produce symptoms is not in accordance with my experience. In the great majority of cases very definite local symptoms are manifest. It is difficult to appreciate the foundation of the statement, as how can it be possible to know that any considerable number of women have a retrodisplacement of the uterus without symptoms? Women who are healthy and who have no discomfort do not consult a physician, and therefore a diagnosis of retrodisplacement could not be made except in the comparatively rare cases of sterility. These women consult the physician in order to learn the cause of sterility, even though they feel well. The usual symptoms of retrodisplacement of the uterus are a sense of discomfort in the pelvis, variously described as a sense of weight, or bearing-down, or pressure. In a certain proportion of the cases backache, difficulty in defecation, and a feeling of pressure against the rectum, are complained of. Reflex nervous symptoms are marked in some of the cases, such as general nervousness, vertical headache, and disturbed digestion. Hysteroidal symptoms are not uncommon. Menstruation may or may not be increased in quantity and frequency. This is also true of leukorrheal discharge. These symptoms may be due to complications even more than to the displacement itself. Dysmenorrhea is not a common symptom of uncomplicated retrodisplacement and is more apt to be present when the displacement interferes markedly with the circulation in the uterus and ovaries. When the retrodisplacement is complicated by laceration of the cervix, by infection of the endometrium, by loss of support of the pelvic floor, or by salpingitis, etc., the symptoms become manifold and are due even more to the complications than to the displacement.

The *diagnosis* of retroversion and retroflexion of the uterus is best made by means of bimanual examination. The cervix is found in its normal position or more commonly low in the pelvis. Upon making bimanual pressure in front of the cervix, the two hands are easily brought together, showing that the corpus uteri is not in its normal position. By palpating more deeply in the pelvis along the posterior wall of the cervix, the uterus is recognized in the hollow of the sacrum either retroverted or retroflexed. The diagnosis can also be made by means of the

uterine sound, but this method of diagnosis presents so many disadvantages that it should not be employed; first because it is unnecessary, and second because it is dangerous. The sound should never be used unless it is first determined that the uterine appendages are free from disease, and any physician who is capable of making this diagnosis is also capable of making the diagnosis of retrodisplacements of the uterus by the bimanual method. Not only should the diagnosis of the position of the uterus be made, but also the condition of the perineum, the vagina, the cervix, the Fallopian tubes, and the ovaries should be determined, as the proper treatment of the individual case depends upon the condition of these contiguous structures.

Indications for Operation.—In the chapter upon Medical Gynecology the indications for local treatment as compared with operative treatment are discussed fully. The extraperitoneal shortening of the round ligaments is indicated in uncomplicated cases of retroversion and retroflexion of the uterus in the majority of cases. The exceptions are the rare cases in which the malposition causes no trouble and, more especially, in recent puerperal cases in which the use of the pessary promises good results. Treatment by the pessary is also to be preferred in certain young matrons of child-bearing age in whom the pessary maintains the uterus in its normal position and can be worn with comfort. The extraperitoneal shortening of the round ligaments is also indicated in all cases of retrodisplacement of the uterus in which the tubes and ovaries are healthy, in which no intraperitoneal adhesions exist, and in which it is necessary to operate for the repair of a laceration of the cervix or perineum. It is poor judgment to subject a woman to such operations and then depend upon the pessary to maintain the uterus in its proper position, when the cure of all the associated lesions can be effected by adding the shortening of the round ligaments to the plastic operations.

When the retrodisplacement of the uterus is complicated by disease of the uterine appendages or by intraperitoneal adhesions, extraperitoneal shortening of the round ligaments is contraindicated. In such cases the abdomen should be opened, the complications dealt with as may be necessary in the particular case; and when one or both uterine appendages can be saved, the retrodisplacement should be cured by means of intraperitoneal shortening of the round ligaments or by suspensio uteri, as may be indicated in the particular case.

The lack of confidence in the Alexander operation expressed by certain authorities is due to the uncertainties of diagnosis. It is claimed by some that this uncertainty is so great that they do not feel confident that in any case sufficient disease of the uterine appendages or else adhesions may not be present as to render the Alexander operation either inadequate to effect a cure or positively dangerous. In my own experience there has been no difficulty from this source.¹

¹ Noble, Charles P.: "Alexander's Operation," *Amer. Gynec. and Obstet. Jour.*, 1899, May; "Remarks on the Influence of Technic upon the Results of Closure of Wounds of the Abdominal Wall," *Boston Med. and Surg. Jour.*, March 8, 1900; "The Treatment of Retrodisplacements of the Uterus," *Trans. Lackawanna County Soc.*, 1905, Scranton.

Edebohl, Geo. M.: "Shortening the Round Ligaments," *Amer. Gynec. and Obstet. Jour.*, Dec., 1896.

The Alexander operation is indicated especially in single women and in married or nulliparous women who furnish no evidence of infection either from gonorrhea or in childbirth. When a careful bimanual examination, corrected by a reexamination under anesthesia when the patient is upon the operating table, does not furnish any evidence of disease of the appendages or of intraperitoneal adhesions, and when the patient is either a virgin or furnishes no history of infection, the risk of error is so slight that it can be disregarded. All that is necessary is care in the selection of cases and the exercise of common prudence in rejecting the Alexander operation in favor of celiotomy in those cases in which there is a reasonable doubt about the diagnosis.

Technic of the Operation.—The same preparation for the operation is required as for celiotomy. The surgical anatomy of the operation is the same as for inguinal hernia, and the landmarks are the spine of the pubes and the anterior superior spine of the ilium. An incision about 5 cm. in length ($2\frac{1}{2}$ in.) is made from the spine of the pubes in the direction of the inguinal canal—that is, a little internal to a line between the spine of the pubes and the anterior superior spine of the ilium. The incision is made through the skin, subcutaneous fat, and superficial fascia, down to the fibers of the external oblique. At this stage and throughout the operation all bleeding points must be seized with forceps, and when of any size the vessels should be ligated with light-weight catgut. If care is not taken to keep the wound dry and free from blood, the tissues become blood-stained and it is very difficult to distinguish the round ligament, even when it is exposed. This is one of the cardinal steps in the operation which leads either to success or failure in the hands of the beginner. When the glistening fibers of the external oblique are exposed, it is well to detach the superimposed fat from the external oblique throughout the length of the incision and laterally for about 1 cm. The external ring should be recognized either by sight or by feeling it with the index-finger just above the spine of the pubes, when the pillars of the ring are caught up upon each side with dissecting forceps. The decussating fibers and the connective-tissue attachments of the parallel fibers of the external oblique are now divided with a knife in the direction of the fibers of the external oblique. In other words, these fibers are split from the external ring to about the position of the internal ring. The external oblique should now be retracted by means of sharp retractors containing three or four teeth, and the retractors should be held throughout the succeeding steps of the operation so as to expose the inguinal canal. At this stage and throughout the operation, if any bleeding occurs, it should be stopped at once by seizing the points with an artery forceps or by means of a ligature. The inguinal canal, being now exposed, should be laid completely bare by detaching the internal oblique muscle from Poupart's ligament by means of the finger or a blunt instrument.

The round ligament should now be looked for and at the same time the ilio-inguinal nerve should be recognized in order that it may be drawn to one side and not injured in the subsequent steps of the operation. If the round ligament is not seen, the outer border of the internal oblique muscle should be rolled in toward the

median line, which procedure, as a rule, exposes the round ligament, which normally lies just within and beneath the outer border of this muscle. If seen, the ligament should be caught with an artery forceps and gently drawn upon until the reflection of the peritoneum is seen, when the peritoneum is detached from the round ligament by means of pressure with gauze, the round ligament being drawn upon until it is sufficiently shortened. If the peritoneum is opened, which will happen in about one-third or one-half of the cases, the rent in the peritoneum should be sutured with fine catgut.

Should there be difficulty in finding the round ligament, which is seldom true, it is best to find the internal ring. This can be recognized in various ways. Its location can be marked by finding the epigastric artery, which curves around the inner border of the internal ring. Usually it is sufficient to pick up the fatty tissue in the bottom of the inguinal canal about 2 or 2.5 cm. from the spine of the pubes. By traction upon the fatty tissues, as a rule, the process of fat which accompanies the round ligament through the internal ring is seen, and when this is drawn upon the round ligament comes into view. Tracing the ilioinguinal nerve upward will also, as a rule, indicate the location of the round ligament. By one of these methods the round ligament can always be found. In my experience, which embraces about two hundred operations, the round ligaments were invariably found in the inguinal canals, with one exception. In this case the ligaments were found in the internal ring, but instead of passing through the inguinal canals the ligaments turned upward and outward toward the anterior superior spine of the ilium. The ligaments were easily recognized at the internal ring, and were drawn out and sutured to Poupart's ligament in the usual way. The experience of Edebohls corresponds to my own, so that in spite of the statements of some authorities there need be no hesitancy in saying that the round ligaments can always be found either in the inguinal canals or at the internal rings.

There are several ways of determining when the round ligaments are sufficiently drawn out for shortening. With experience the operator is usually able to determine this point through his muscular sense. Those who are less experienced should determine the question by one of two methods. When both round ligaments are supposed to be sufficiently shortened, the ligaments should be drawn upon alternately and an assistant should palpate the hypogastrium just above the pubes. If the uterus is in position, it will be recognized under the abdominal wall and can be felt passing from one side to the other as the round ligaments are drawn upon alternately. The question of the degrees of shortening of the ligaments can be determined by noting whether the uterus moves coincidentally with the traction upon the round ligaments. This will be true if the round ligaments are shortened; that is, if the slack of the ligament in its curvilinear course through the broad ligament has been drawn out. When the peritoneum is opened, which happens in from a third to a half of the cases, the index-finger may be introduced through the internal ring and through the opening in the peritoneum and the uterus itself palpated. This method is a part of the technic of Goldspohn, and determines absolutely the position of the

uterus. For the operator of experience it is unnecessary. When both ligaments have been sufficiently drawn out, the operation is completed by performing the Bassini operation for inguinal hernia and having the sutures which attach

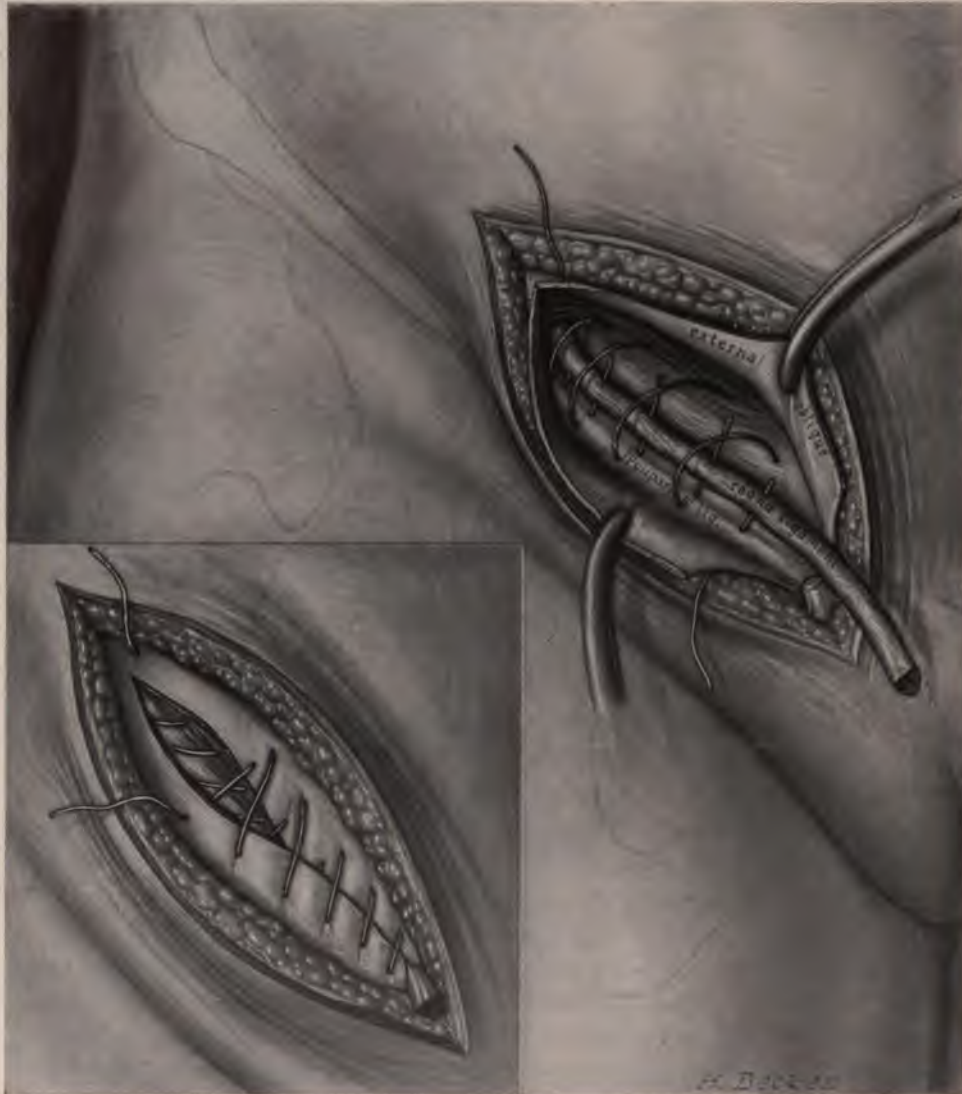


FIG. 290.—THE ALEXANDER OPERATION.

A, The inguinal canal is laid open; the round ligament is drawn down; the canal is obliterated by suturing the internal oblique and round ligament to Poupart's ligament. B, Overlapping the external oblique by continuous suture.

the internal oblique to Poupart's ligament pass through the round ligament, so that the round ligament is attached to Poupart's ligament at the same time that the inguinal canal is obliterated. The ilioinguinal nerve is located so that it

shall not be included in the sutures. This procedure is carried out by myself as follows: A medium-weight chromicized catgut suture threaded upon a full-curved needle is passed through the external oblique to the inner side of the wound at the level of the internal ring. The needle then passes through the internal oblique, through the shortened round ligament, and through Poupart's ligament. It then passes through the internal oblique, the round ligament, and Poupart's ligament, and again through the same structures, when it is made to emerge through the external oblique at the external ring. The divided external oblique is then sutured by the overlapping method, as described in the section upon the Closure of the Celiotomy Incision (page 533; also Figs. 285, 286). When the upper end of the incision in the external oblique is reached, the two ends of the suture are tied. The subcutaneous fat is closed with a running suture, and the skin with a subcuticular suture. The method is that of Edebohls, with the exception of the use of the principle of overlapping the aponeurosis. When both wounds have been sutured, the usual dressing of gauze and cotton is applied. As the wounds are very low on the abdominal wall, special care must be taken to fix the dressing, lest it become displaced during the convalescence and thus afford an opportunity for the late infection of the wounds. It is a popular belief that wounds in the groin, whether for the Alexander operation or for hernia, are more apt to suppurate than wounds elsewhere. This belief is due to the careless application of dressings and the failure to secure their fixation. The dressings should be fixed not only by the usual transverse straps of adhesive plaster, but the lowest as well as the highest strap should be broad and should extend beyond the dressing, so that the dressing is fixed not only laterally but also above and below. This fixation should be reinforced by means of a strap which passes around the inner side of each thigh near the trunk and then upward and outward over the groin to the sides of the pelvis. By this means the dressing can be fixed securely and the wounds in the groins protected from late infection.

After-treatment.—This is the same as the after-treatment of celiotomy cases except that the diet can be made liberal at an earlier period. As soon as the patient's bowels have moved she can be put upon liquid diet, and upon light soft diet so soon as her appetite demands it.

Prognosis.—The mortality of the Alexander operation is practically *nil*. In my experience there have been no deaths. A death following the Alexander operation would be due either to a surgical accident, to some medical complication, or to the accidental infection of the wound.

The prognosis as to the anatomic cure of the patient is excellent. In my experience there has been one failure and one partial failure in about two hundred operations. This compares most favorably with the results of *suspensio uteri*, in which at least 5 per cent. of relapses are encountered. The results of the operation as to symptomatic cures are equally good. Some authorities have reported results far less satisfactory, but these results must have been due to confounding the symptoms of some neurosis, or the symptoms due to other conditions, with

those due to retrodisplacement of the uterus for which the operation is indicated.

There are various secondary questions concerning the operation which are deserving of consideration and which will now be discussed seriatim.

What Shall Be Done when One or Both Round Ligaments are Torn?—

Rupture of the ligament may occur in drawing the round ligament through the internal ring. The round ligaments are not always well developed. In a minority of cases they are quite small. This is true in cases of poorly developed sexual organs, and is more frequently true in women who have never done physical labor and who have a poor physical development. In certain of these cases the round ligaments are quite small, and unless great care is taken in drawing them through the internal ring, they may be ruptured. This accident is more apt to occur when the operation is undertaken shortly after labor or after abortion. In post-puerperal cases the ligaments are subinvolved and very frangible. It is not best to undertake the operation within six or eight weeks after labor. When one or both ligaments tear, the course to be followed must depend upon circumstances. If the torn end can be caught and drawn out, the operation can be proceeded with in the usual manner. If the ligament is lost within the abdomen, it is best to abandon the operation and to perform either suspensio uteri or intraperitoneal shortening of the round ligaments.

The Strength of the Round Ligaments.—The amount of traction necessary to rupture a round ligament differs markedly in different subjects. Edebohls states that it varies between 3 and 15 kilograms. The muscular sense of the operator is the best guide to the amount of traction which can be applied in shortening the round ligament without rupturing it.

The objection is made to the Alexander operation that the round ligaments are not sufficiently strong to sustain the uterus in its forward position. Were it true that the round ligaments were called upon to sustain the uterus in its position of ante flexion, this objection would be well founded; but this is not true. The function of the round ligaments is merely to draw the fundus in front of an imaginary line into that position which permits the force of intra-abdominal pressure to fall upon the posterior wall, thus converting intra-abdominal pressure into a conservative instead of a destructive force. It is the constantly acting force of intra-abdominal pressure which maintains the uterus in its forward position; and the function of the round ligaments in producing this result, while necessary, is, after all, of far less importance than the force of intra-abdominal pressure.

Hernia Following the Operation.—Those who do not favor the Alexander operation allege as one of the objections to it that it is followed by inguinal hernia, and support their contention by references to the reports of hospitals dealing with the ruptured and crippled. It is true that some instances of rupture following the Alexander operation are upon record, but these have been due to faulty technic or to suppuration. In my own experience, embracing about 200 cases, no post-operative hernias are known. Edebohls reports one case in which double

hernia followed pregnancy subsequent to the Alexander operation in 106 operations. That post-operative hernia should occur rarely or not at all is indicated by the results reported by surgeons in the cure of inguinal hernia in women by the Bassini operation. Recurrences are very rare. If the Bassini operation affords almost perfect results in the cure of inguinal hernia, *a priori* when performed upon an inguinal canal which has not been the seat of hernia, the subsequent development of hernia would be far less apt to occur than as a secondary result of the radical cure of inguinal hernia in women.

Pregnancy Following the Alexander Operation.—Edebohls reports 18 pregnancies occurring in 11 of his 115 Alexander operations.¹ Of 173 Alexander operations performed by the author,² 95 patients were traced; and in these 39 pregnancies were recorded. Three patients were pregnant three times each, and 3 patients were pregnant twice each. In Edebohls' cases there were 2 abortions, and in mine 9 abortions, making 11 abortions in 57 pregnancies—a ratio not higher than that which usually obtains.

The only complication noted during pregnancy was a certain amount of tugging in the groins, caused by the traction of the enlarging uterus upon the shortened ligaments. In certain women this symptom was quite annoying, in others it was merely sufficient to attract their notice. No instances of dystocia were recorded. This experience is quite in accord with that published by other writers, and therefore it may be assumed that an Alexander operation in no way interferes with the course of pregnancy or labor.

INTRAPERITONEAL SHORTENING OF THE ROUND LIGAMENTS.

In the history of the operation reference has been made to the operations devised by Wylie, Dudley, and Mann, in which the round ligaments were folded upon themselves or stitched to the uterus, with the object of maintaining the uterus in its normal position of ante flexion. These operations must be regarded as being of value from the historical standpoint. Reference was also made to the procedure of Ferguson, who divided the round ligaments about 1½ inches from the uterus, and then sutured the proximal end of the round ligaments to the anterior abdominal wall, perforating the aponeurotic sheath, the rectus muscle, and peritoneum upon each side of the median line, drawing each round ligament through the abdominal wall and suturing it to the aponeurosis of the external oblique. This procedure led to the operation of Gilliam, who omitted the step of dividing the round ligaments, and instead sutured a loop of the round ligament after the manner of Ferguson. Gilliam's operation has the merit of simplicity, but the fact that it divides the pelvic cavity into three segments (one external to each round ligament and one between the ligaments), any one of which may serve as a pocket in which the bowel may

¹ Edebohls, George M.: "Shortening the Round Ligaments," Amer. Gynæc. and Obstet. Jour., Dec., 1896.

² Noble, Charles P.: "The Treatment of Retrodisplacements of the Uterus," Trans. Lackawanna County Soc., 1905.

become incarcerated, led Simpson to devise the retroperitoneal shortening of the round ligaments. This procedure shortens the round ligaments and attaches the shortened ligaments to the anterior abdominal wall, and leaves but a single opening into the pelvic cavity. The operation should obviate the possibility of strangulation of the bowel, provided the uterus does not become attached to the abdominal incision. This possibility is not merely a theoretic one, as it has happened once in the experience of Simpson, when not only were the round ligaments shortened but the uterus also became suspended from the attachment of the fundus to the abdominal incision. The bowel became caught in one of the pockets so formed and chronic obstruction resulted.

The retroperitoneal shortening of the round ligaments as proposed by Simpson has been carried out by various gynecologists in a slightly different manner, so that the technic of the operation will be described as it is performed by myself, giving full credit to Simpson for the conception of the principle, and to Mann and Ill for two steps of the operation.

Technic of the Operation.—The preparation of the patient for the operation is the same as for any abdominal section. The abdomen is opened through the right rectus muscle a little to the right of the median line. An incision 5 cm. (2 in.) in length is usually sufficient, but the incision must be made to meet the necessities in the particular case. Whatever complications are present must be recognized and dealt with as indicated, by the separation of adhesions, removal of one tube or ovary, etc. The complications being satisfactorily dealt with, the operation is proceeded with as follows: One round ligament is caught about 5 cm. from the cornua of the uterus, and a provisional ligature of silk or catgut is passed under it. This point is about one-third the distance from the cornu of the uterus to the internal abdominal ring. The round ligament is then caught at a point half-way between the provisional ligature and the internal ring, and is held by means of an artery forceps. This point is then sutured to the round ligament at its junction with the uterus by means of two light silk or chromicized catgut sutures. This step of the operation corresponds to a similar step in the operation of Mann. As a result of these sutures, the uterus is held forward by that portion of the round ligament which runs through the inguinal canal. The proximal two-thirds of the round ligament now forms a loop, the middle of which is caught by the provisional ligature already described. Sufficient traction is now made upon the provisional ligature to expose the anterior face of the broad ligament, when the peritoneum covering it is torn through, just below the round ligament. An opening large enough to admit the index-finger is sufficient. If the operator stands upon the patient's right side, the next step of the operation is to open the sheath of the left rectus muscle. A blunt aneurysm needle is then passed between the aponeurosis of the external oblique muscle (external sheath of the rectus) and the rectus muscle. The needle is passed under the sheath of the rectus to the outer border of the muscle. It then penetrates the rectus and passes beneath the peritoneum to the internal ring. The point of the needle is then made to follow the round ligament along the

anterior face of the broad ligament to the rent in the peritoneum already described. This step of the operation is facilitated by elevation of the anterior abdominal wall

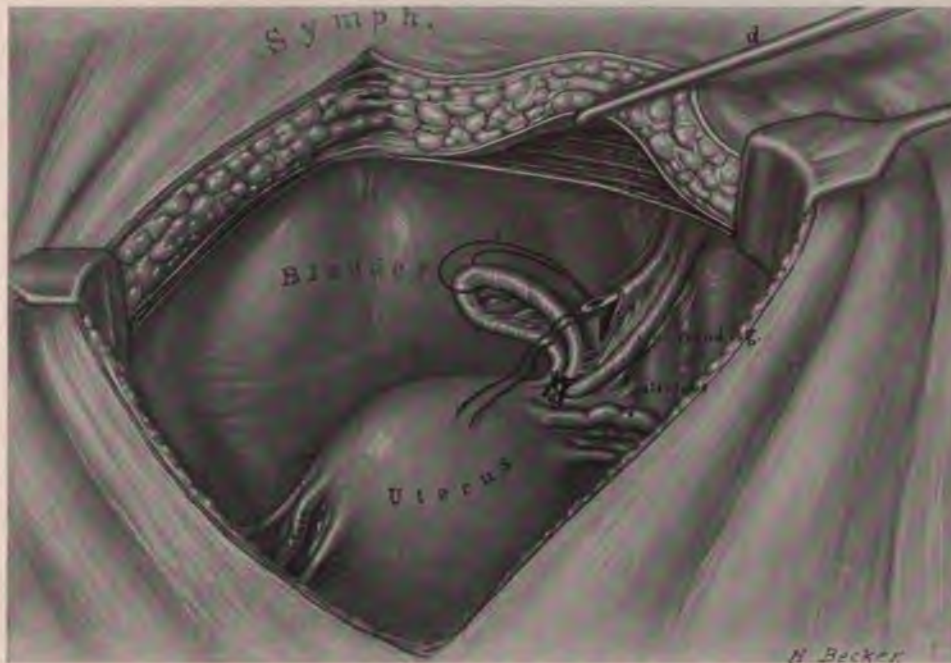


FIG. 291.—RETROPERITONEAL SHORTENING OF THE ROUND LIGAMENTS.

a, Round ligament at its outer third sutured to the round ligament at the uterine cornu, making a loop of its inner two-thirds—the first step of Mann's operation; b, opening through peritoneum on the anterior face of the broad ligament; c, provisional ligature around the round ligament, about one and one-half inches from uterine cornu; d, Deschamps' needle which is passed between the rectus muscle and the aponeurosis of the transverse muscles to the internal ring and then along the round ligament to the opening in the peritoneum at b; the provisional ligature is threaded in the eye of the needle and drawn through to the median abdominal incision; by traction on the ligature the round ligament is drawn into the wound to be sutured to the aponeurosis.

(elevation rather than lateral traction). When the needle emerges through the rent in the peritoneum, the provisional ligature is threaded through the eye of the aneurysm needle and the needle is withdrawn, bringing with it the provisional ligature. Traction upon the ligature causes the loop of round ligament to pass beneath the peritoneum, across the anterior face of the broad ligament to the internal ring, and then beneath the peritoneum of the anterior abdominal wall to the outer border of the rectus muscle, then through the muscle and between it and the aponeurosis of the external oblique muscle until it emerges in the abdominal incision. Frequently the peritoneum is dragged in front of the round ligament and must be sepa-



FIG. 292.—RETROPERITONEAL SHORTENING OF THE ROUND LIGAMENTS.

The round ligament is sutured to the under surface of the aponeurosis of the transverse muscles.

rated to permit its retraction. The loop of round ligament is now sutured to the under surface of the aponeurosis of the external oblique by continuous or interrupted sutures of chromicized catgut. Two sutures usually suffice. This step of the operation is borrowed from Ill's modification of the typical Gilliam operation. The operator should then pass to the opposite side of the patient and shorten the right round ligament in a corresponding manner. The abdominal incision is then closed. Figs. 291, 292, and 293 very clearly illustrate the steps of the operation.

The various methods of shortening the round ligaments within the abdomen are all too recent for the formation of a final estimate as to their value in compari-

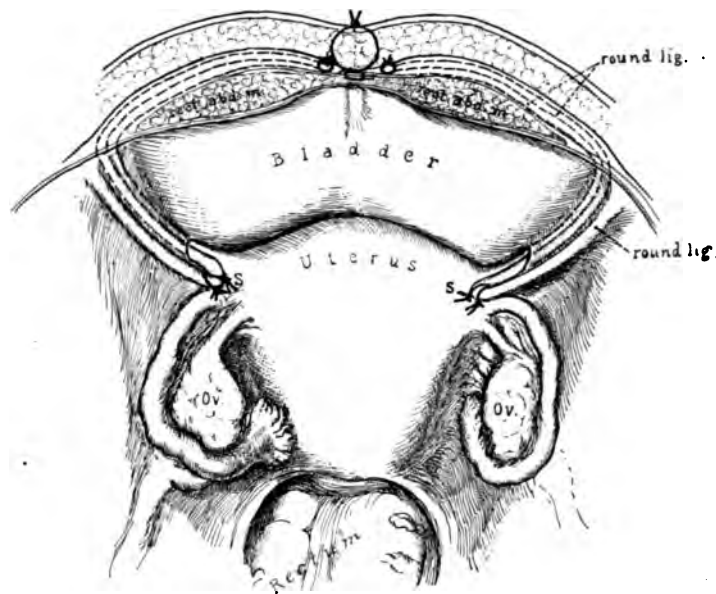


FIG. 293.—RETROPERITONEAL SHORTENING OF THE ROUND LIGAMENTS.

Schematic view of the operation, showing the artificial position and the points of suturing of the round ligaments.

son with the well ascertained permanent results of the Alexander operation and of Kelly's operation for the ventral suspension of the uterus. This applies not only to the permanent anatomic and therapeutic results of the operation, but also and more particularly to the influence of these operations upon the course of pregnancy and labor. Theoretically either the Gilliam operation or the retroperitoneal shortening of the round ligaments should not interfere either with pregnancy or labor. The round ligaments should develop during pregnancy as they do after the Alexander operation, and should not lead to dystocia; but sufficient time has not elapsed for final conclusions upon these points, based upon actual experience.

SHORTENING THE UTEROSACRAL LIGAMENTS.

BY CHARLES P. NOBLE, M.D.

By shortening the uterosacral ligaments is meant the shortening of these structures by folding them upon themselves and fastening the folds with sutures, either by abdominal section or by vaginal section.

History.—In 1850 Amussat¹ practised obliteration of the space between the cervix and the posterior wall of the vagina by the application of caustic potash and the actual cautery to these surfaces and the formation of adhesions between them. He then tamponed in front of the cervix. This procedure presumably did not involve the uterosacral ligaments, but must be considered in the development of the operation. In 1883 Herrick² modified this procedure by suturing the cervix to the posterior vaginal wall. This operation was also done by others. In 1883 Frömmel³ proposed the shortening of the uterosacral ligaments by the abdominal route. In 1888 Byford⁴ mentioned Amussat's procedure. He also reported two cases of shortening the uterosacral ligaments through the vagina (*loc. cit.*, p. 525). In 1889 Freund⁵ shortened these ligaments through the vagina and suggested it also by the abdominal route. Herrick, Säger, Hochenegg, Gottschalk, and Godinho practised the shortening of the uterosacral ligaments through the vagina.⁶ Wertheim and Mandl⁷ in 1896 shortened both the uterosacral ligaments and the round ligaments by the vaginal route. Bovée (*loc. cit.*) and Goffe began shortening the uterosacral ligaments through the vagina in 1897. Since that date the operation has been more or less extensively practised through both the abdominal and the vaginal routes by many others.

Conditions for Which the Operation May Be Done.—In general the shortening of the uterosacral ligament is indicated whenever these structures are overstretched. Practically the field for the operation is limited to cases of retrodisplacement of the uterus and to cases of prolapsus of that organ. For retrodisplacement of the uterus shortening of the uterosacral ligaments should be combined with shortening of the round ligaments. For prolapse of the uterus the operation should be preceded by the necessary plastic operations upon the cervix, the anterior vaginal wall, the posterior vaginal wall, and the perineum, and should be

¹ Amussat, J. Z.: "Note sur un nouveau moyen de guérie la rétroversion de l'utérus," *Gaz. de Med.*, Paris, 1850, xxi, 159.

² Herrick, O. E.: "Operation for Closing Douglas' Cul-de-sac," *Obstet. Gaz.*, Cincin., Feb., 1883, vol. vi, No. 2, p. 57.

³ Frömmel, R.: "Ueber operative Behandlung des retroflektirten Uterus," *Centralbl. f. Gynäk.*, Feb. 8, 1890, p. 94.

⁴ Byford, Henry T.: "Diseases of Women, Medical and Surgical," Phila., 1888, 4th ed., p. 535.

⁵ Freund, W. A.: *Centralbl. f. Gynäk.*, July 27, 1889, p. 515.

⁶ Bovée, J. Wesley: "Operations on the Utero-sacral Ligaments in the Treatment of Retroversion of the Uterus," *Amer. Gynecology*, July, 1902, p. 15.

⁷ Wertheim, E., and Mandl, L.: "Die Verkürzung der Ligamenta rotunda und der Ligamenta sacro-uterina mittels Coeliotomia vaginalis anterior," *Centralbl. f. Gynäk.*, May 2, 1896, S. 465.

followed by shortening the round ligaments or by *suspensio uteri*, or by ventral fixation of the uterus. For the pathology, etiology, and diagnosis of retrodisplacement and prolapse of the uterus, the reader is referred to the sections treating of these conditions.

The typical indication for shortening the uterosacral ligaments is found in cases of prolapse of the uterus with extreme overstretching of the uterosacral ligaments, especially when this condition is associated with posterior enterocele.

Contraindications.—The operation for the shortening of the uterosacral ligaments being a comparatively recent one, the contraindications to the operation deserve special consideration. Relaxation or overstretching of the ligaments following labor and superinduced by subinvolution should not be treated by operation. The use of vaginal tampons and astringent douches, together with the internal administration of strychnin, digitalis, and ergotin, should bring about involution and effect a cure. For some cases the use of a Smith-Hodge or an Emmet pessary would be desirable after the cessation of the tampon treatment.

The results obtained by shortening the uterosacral ligaments are not uniformly satisfactory. W. M. Polk (private communication) reports eight operations for the shortening of the uterosacral ligaments by the vaginal route, performed between November 12, 1894, and November 23, 1896. His results were so unsatisfactory that he abandoned the operation. He states: "Anatomically it appeared to place the uterus too low; therapeutically it did not offer the relief from the symptoms which I thought desirable; combined with shortening the round ligaments it certainly held the uterus anteriorly, but vexatious symptoms appeared in every one of the cases, the symptoms being much like those which we find in old adhesive inflammations about Douglas' cul-de-sac. In at least one case there was partial obstruction of the rectum." In my own experience, the very cases in which the operation is most indicated—namely, those of complete prolapse with great overstretching of the uterosacral ligaments and detachment of the posterior wall of the vagina from the rectum, with or without posterior enterocele—are those in which the conditions present render the operation difficult or relatively hazardous. This extreme type of prolapse of the uterus is most often found in elderly women, many of whom are fat and who take an anesthetic poorly or badly. At the conclusion of the various plastic operations upon the uterovaginal canal, to add the shortening of the uterosacral ligaments to a suspension or fixation of the uterus has often proved unwarrantable because of the condition of the patient. This practical difficulty is the reason why, after performing the operation a number of times about 1896, it has been performed but seldom by myself in the past ten years. The uniformly satisfactory results secured by the other methods for dealing with retrodisplacements and prolapse of the uterus also have caused me to shorten the uterosacral ligaments but seldom, and to reserve it for cases of unusual overstretching of the ligaments with posterior enterocele. The operation has been done recently in the effort to avoid the performance of *suspensio uteri* by those who hold unfavorable views as to the merits of Kelly's operation.

Operation.—The operation may be done either by abdominal or vaginal section. The preparation of the patient is the same as for other abdominal and vaginal operations.

By Vaginal Section.—The operation is best performed with the patient in the lithotomy position. The cervix is exposed by retracting the perineum with the Edebohls self-retaining speculum. The cervix is seized with tenaculum forceps and drawn downward and forward, exposing the posterior vaginal fornix. Bovée (*loc. cit.*) thus describes the remaining steps of the operation: "An antero-posterior incision is made through all the structures of the posterior vaginal fornix except the



FIG. 294.—SHORTENING THE UTEROSACRAL LIGAMENTS.

The suture *a* is passed through the ligament one inch from the uterus, and again about one inch from the rectum.



FIG. 295.—SHORTENING THE UTEROSACRAL LIGAMENTS.

A second suture is passed at *b*. When tied, sutures *a* and *b* usually shorten the ligament sufficiently. If not, an additional suture may be passed nearer to the uterus and to the rectum.

peritoneum, extending approximately from the cervix to the rectum. By careful dissection the ligaments are brought out plainly to view. Then grasping one of them with a forceps midway between the extreme points to be united and lessening the traction on the cervix at the same time, the fold of ligament is brought down into the vagina. Then a curved needle armed with kangaroo tendon is passed through the ligament at the extreme points noted and another through the loop thus formed and through the posterior portion of the cervix below the insertion of the ligaments. When the other ligament has been treated in a similar manner the two

deep sutures are tied and then the others. The wound is now spread well open and the two ends of it approximated by a continuous kangaroo tendon suture. When the wound is closed it appears to have been originally a transverse one." The opening of the peritoneal cavity will facilitate the operation in certain cases and should add but little to its risk. Catgut or fine silk may be substituted for kangaroo tendon for suture material.

By Abdominal Section.—The operation is best done with the patient in the exaggerated Trendelenburg posture. The abdominal incision should be sufficiently long to facilitate the steps of the operation. The intestines must be removed from the pelvis and kept in the abdominal cavity by means of gauze packing. The uterus is held forward and upward by means of a long retractor, traction upon which puts the uterosacral ligaments upon the stretch and brings them more prominently into view. A fine silk suture is passed through one uterosacral ligament about 2 cm. from the uterus from without inward and about the same distance from the rectum from within outward. This suture when tied will usually give the necessary amount of shortening of the ligaments, but this must be arranged to suit the particular case. One or more additional sutures are then passed to secure neat approximation of the slack portion of the ligament. Figs. 294 and 295 afford an excellent representation of the details of the operation.

Additional operations if indicated in the particular case can now be performed. The after-treatment is the same as that of other abdominal operations.

Prognosis.—The risk to life of shortening the uterosacral ligaments either by the vaginal or abdominal route is slight. Combined with plastic operations, shortening the round ligaments, or suspensio uteri, it should be followed by a mechanical cure of retrodisplacement and prolapse of the uterus. The operation has not had an extensive trial, and therefore the final estimate as to its value must be left to the future. It is my own opinion that it will prove most useful in cases of procidentia of the uterus with extreme overstretching of the uterosacral ligaments, with or without posterior enterocele.

VENTRAL SUSPENSION OF THE UTERUS.

BY BEVERLY MACMONAGLE, M.D.

Definition.—An operation for sustaining the uterus in its normal position by suturing it to the abdominal wall, thereby causing the formation of a fibrous band 3 to 5 centimeters long, and a few millimeters to 1.5 centimeters in breadth, between the fundus of the uterus on its posterior aspect and the anterior abdominal wall.

History.—In a modest monograph, since become historic, entitled "Hysterorrhaphy," read before the Philadelphia Obstetrical Society, Nov. 4, 1886, Howard A. Kelly¹ described an original operation for deviations and prolapse of

¹ Kelly, Howard A.: "Hysterorrhaphy," *Amer. Jour. Obst.*, Jan., 1887, vol. xx, No. 1, pp. 33-46. *Ibid.*, *Jour. Amer. Med. Assoc.*, Dec. 11, 1886, vol. vii, No. 24, p. 666. *Ibid.*, *The Johns Hopkins Hospital Bulletin*, Jan., 1890, vol. i, No. 2, pp. 17-19.

the uterus. Since that time, although the operation has been variously modified and named by different operators in this field, yet to Kelly belongs the credit for the improvements through which the operation has reached its present state of perfection and which have caused it justly to stand as one of the most frequently performed and satisfactory of gynecologic operations.

As an originator, equal credit must be given to Olshausen,¹ of Berlin, who, working independently, published a paper, October 23, 1886, entitled, "Ueber ventrale Operationen bei Prolapsus und Retroversio uteri." Kelly performed the first operation April 25, 1885. At dates earlier than these we find that the idea of attaching the uterus to the anterior abdominal wall was occasionally carried out (in conjunction with other abdominal work) by several different operators; it was never recommended as a distinct operation. Koeberle, Lawson Tait, Müller, Schroeder, Hennig, Werth, Keith, von Bardenheuer and Czerny are among those who reported early cases.

Nomenclature.—The operation, originally named by Kelly "hysterorrhaphy," has also come to be known under the names of hysteropexy, ventrofixation, ventral fixation, suspensio uteri, suspension of the uterus, and ventrosuspension of the uterus.

The experimental stage of the operation is now past and the time has arrived for uniformity in nomenclature. Hysterorrhaphy, hysteropexy, and suspension of the uterus are all too indefinite. They convey the idea of suturing or attaching the uterus, but fail to specify to what it is attached. Suspensio uteri has the same fault, besides being a Latin term. In ventrosuspension we have the combination of a Latin and an English word. Besides the faults in the other terms pointed out by Edebohls,² the use of the word fixation in any form as a name for this operation is to be condemned, chiefly for the reason that the operation as now performed is by no means a fixation of the uterus but a suspension.

It has become important for statistical studies that a definite and clear distinction be made between "ventral fixations" and "ventral suspensions" of the uterus. The name to be preferred for this operation is therefore ventral suspension of the uterus, combining, as it does, a good English name with an idea of the operation.

Methods of Operation.—The operative technic has undergone gradual evolution. At first crude, followed by a considerable number of relapses, and adding many difficulties to pregnancy and labor, it has now become perfected, so that both these dangers have been largely overcome.

Kelly in his original article recommended that a continuous or interrupted suture be passed through each cornu of the uterus and the body be thus attached to the abdominal wall at points on either side of the incision; Olshausen in his first operation made use of the cornua of the uterus and, in his second case, of the round liga-

¹ Olshausen, R.: "Ueber ventrale Operation bei Prolapsus und Retroversio uteri," *Centralbl. für Gynäk.*, Sonnabend, den 23. Oktober, 1886, No. 43, S. 698–701.

² Edebohls, Geo. M.: "The Indications for Ventral Fixation of the Uterus," *Medical News*, March 14, 1896, vol. lxviii, No. 11, pp. 282–287.

ments; Sanger¹ passed two silver wire sutures through the right broad ligament close to the uterine cornua.

The considerable number of relapses which followed these methods brought about an endeavor to fix the uterus more firmly against the abdominal wall. Many modifications arose. Leopold² adopted the method of scarifying the peritoneum of the uterus and abdominal wall; others, in order to obtain a firm attachment, denuded even a larger surface of the anterior uterine wall, at the same time passing their sutures through the muscle and fascia of the abdominal wall. Olshausen's present technic is to attach the cornua of the uterus to the abdominal wall with silkworm-gut sutures buried at the aponeurosis. He aims at a firm attachment of the uterus, as does Leopold, who scarifies the fundus and passes sutures through the entire thickness of the abdominal wall.

All these methods suspend the uterus by bringing its anterior surface against the abdominal wall. If a fixation is produced, the uterus is held in an unnatural position and offers a serious obstacle to pregnancy and labor; if a suspension-ligament forms, as undoubtedly happens in many cases, the uterus is placed at a great mechanical disadvantage; intra-abdominal pressure constantly exerts itself against the anterior surface and fundus of the uterus and tends to reproduce the displacement. A realization of these facts, together with the discovery by Kelly, Penrose,³ and others, on reopening the abdomen, of the suspension band stretching from the uterus, in normal position, to the anterior abdominal wall, led to the present technic of passing the suspension suture through the peritoneum and subperitoneal tissue only, and transfixing the fundus of the uterus a little on its posterior aspect, thus keeping it in a slightly anteflexed position. The force of intra-abdominal pressure after this technic readily lengthens the adhesion, allowing the uterus to settle into a normal, easy position, at the same time increasing the anteversion of the fundus.

Indications.—The operation of ventral suspension of the uterus should not be resorted to for simple retrodisplacement of the uterus unless the failure of other and simpler methods of treatment makes it a necessity. Reposition, packing of the vagina, the use of the pessary, and a resort to plastic work on the perineum, vagina, and cervix in some cases, should all have been tried and proved futile. If, after an honest endeavor along these lines, the patient is still tied to the physician's office with the ailment, or her health is seriously affected, this operation may be recommended. The following are its more usual indications:

1. A retroflexed uterus bound down by adhesions.
2. A retroflexed uterus with diseased tubes and ovaries. If the adnexa require complete removal it is better to amputate and remove the uterus instead of suspending it.

¹ Sanger, M.: "Ueber operative Behandlung der Retroversio-flexio uteri," *Centralbl. fur Gynak.*, Januar, 1888, Nr. 2, S. 17. *Ibid.*, *Centralbl. fur Gynak.*, 21 Januar, 1888, Nr. 3, S. 34.

² Leopold, C. G.: "Ueber die Annahung der retroflektirten aufgerichteten Gebarmutter an der vorderen Bauchwand," *Centralbl. f. Gynak.*, 1888, No. 11, S. 161.

³ Penrose, Charles B.: "A Uterus Removed Eighteen Months after the Operation of Ventrosuspension," *Amer. Jour. Obst.*, Aug., 1896, vol. xxxiv, No. 2, p. 264.



FIG. 296.—THE TECHNIC OF VENTRAL SUSPENSION OF THE UTERUS.

3. Prolapse of the uterus and vagina. In these cases a suspension must be combined with the necessary plastic work on perineum, vagina, and cervix, otherwise relapse will most certainly occur.

4. If, during the operation for shortening the round ligaments, where this procedure is indicated, the round ligaments unfortunately rupture on one or both sides, the operation of ventral suspension should be substituted.

5. As pointed out by Edebohls,¹ certain cases of uterus unicornis call for ventral suspension.

Contraindications.—It has been my rule to consider retroflexed or retroverted non-adherent uteri without diseased adnexa as suitable cases on which to do the operation for shortening the round ligaments, believing the procedure to be satisfactory in its results and offering little danger to the child-bearing woman. Lately the number of relapses I have seen following the operation of shortening the round ligaments accord with the experience of Peet,² and believing that ventral suspension statistics from which "fixations" have been eliminated will show pregnancy and labor uninfluenced, has led me gradually to adopt ventral suspension for many of these cases. In a woman past the child-bearing age presenting prolapsus of the uterus, I prefer ventral fixation to ventral suspension, wishing at this period to get a thicker and firmer adhesion. In cases of retroflexion in which the adnexa are so diseased as to require complete removal, I believe, as stated before, that the uterus is but a useless organ and a frequent source of trouble afterward, and therefore recommend hysterectomy.

Objections to the Operation.—The objections which have been urged against the operation are:

1. That the uterus is fixed and held in an unnatural position.
2. That dysuria is a common and persistent after-symptom, produced either by pressure on the bladder by the uterus, or from an inability of the bladder to expand properly.
3. That serious difficulties arise during pregnancy and labor.

The first and second objections cannot hold against a properly performed ventral suspension operation. The adhesion between the uterus and the anterior abdominal wall soon lengthens into a long, narrow band, permitting the uterus to reach its normal level in the pelvis, as a rule, two or three months after the operation. The second objection, that of dysuria as an after-symptom, I believe to be more or less theoretic, even before the uterus has had time to seek its normal level in the pelvis. In my own experience I do not find this symptom complained of, even after ventral fixations of the uterus, any more frequently than after other abdominal operations.

Numerous cases have been reported in which difficulties have arisen during pregnancy and labor. On closer examination it will be found that nearly all, if

¹ Edebohls, Geo. M.: *Medical News*, March 14, 1896.

² Peet, E. W.: *Med. Record*, Nov. 12, 1898, vol. liv, No. 20, p. 711.

not all, these unfortunate complications followed the operation of ventral fixation and not ventral suspension of the uterus.

Noble¹ has collected cases from American sources, and made a careful study of this subject, but because of the interchangeable use of the names "fixation" and "suspension" of the uterus by all operators, he was unable to distinguish between the cases operated upon by ventral suspension, ventral fixation, or any one of their many modifications.

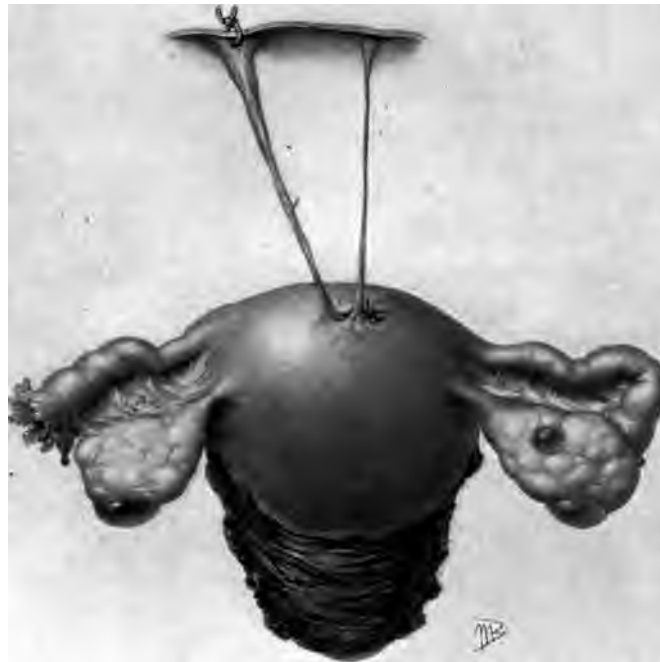


FIG. 297.—VENTRAL SUSPENSION OF THE UTERUS (Kelly).

Showing the long, overstretched, artificial ligaments which sometimes form after the operation.

The two cases presenting difficulties during labor in his own practice were cases of ventral fixation.

It is probable that most of the cases reported in which difficulties were encountered during labor were cases of "fixation" of the uterus, when we consider that out of the total number of 808 cases reported, about one-fourth were those of Kelly—an operator who does ventral suspension only, and who has had but one case presenting any serious difficulties during labor. This was one of his earlier operative cases in which the uterus was suspended by the ovarian ligaments, and in which suppuration occurred in the abdominal wall, producing a dense adhesion of

¹ Noble, Charles P.: "Suspensio Uteri with Reference to its Influence upon Pregnancy and Labor," *Trans. Amer. Gynec. Assoc.*, 1896, vol. xxi, pp. 247-268.

the uterus to the abdominal wall, resulting in a "fixation" instead of a suspension operation. Dickinson¹ has reported a case of Cesarean section on a patient in whom Kelly had done a myomectomy and suspended the uterus. The patient had a twin pregnancy and a hypertrophied anterior uterine wall obstructing the pelvis. She died after a Cesarean section simply from shock, without any apparent cause.

From my own operations of ventral suspension, now numbering nearly 250, I have never heard of any serious inconvenience during pregnancy and labor. One of my cases reports the birth of triplets, delivered by a midwife. The patient's uterus, on later examination, I found to be movable and in good position.

The conclusions reached by Noble from his collated cases show, first, that the most serious difficulty during labor is uterine inertia due to an inability of the fixed anterior uterine wall to expand, with a consequent thinning of the posterior and lateral walls of the uterus, resulting in an impaired expulsive power; second, the occurrence, more rarely, of an obstruction to labor from the greatly hypertrophied anterior wall of the uterine body forming a tumorous mass resembling a fibroid in the anterior uterine wall and preventing the descent of the fetus by obstructing the superior strait. The occurrence of either of these serious complications can only follow a "fixation" of the uterus in which the anterior wall is so firmly held against the abdomen by a dense adhesion that the uterine wall is unable to expand and the uterus is prevented from sinking into the pelvis.

In ventral suspension, on the other hand, the uterus is sustained by an adhesion 3 to 5 mm. long, freely movable and with an ability to expand in all directions during pregnancy, as shown by Kelly's² reported cases.

An important suggestion is made by Noble that in cases becoming pregnant after ventral suspension or ventral fixation of the uterus an examination should be made during the progress of pregnancy. If the cervix is dragged up, or if a tumorous mass is felt through the anterior abdominal wall, labor should be induced at least four weeks before term.

Technic of the Operation.—The high mortality from infection, following any operation which necessitated opening the abdomen in the past, prevented the performance of a distinct abdominal operation for a condition not of itself fatal. The most rigid aseptic and antiseptic technic should therefore be followed in the preparation of the patient and by those taking part in the operation.

The nature of the condition for which this operation is done eliminates the necessity for haste. A week or longer, if possible, should therefore be devoted to the study and careful preparation of the patient. This should consist of a complete physical examination, the regulation of rest, diet, the bowels, daily baths, vaginal

¹ Dickinson, Robert L.: "Pregnancies Following Ventral Fixations, One Ending in Rupture and One in Cesarean Section," *Amer. Jour. Obst.*, July, 1901, vol. xlv, No. 1, pp. 34-46.

² Kelly, Howard A.: "Suspension of the Uterus," *Jour. Amer. Med. Assoc.*, Dec. 21, 1895, vol. xxv, No. 2, pp. 1079-1081.

douches, and oil-rubs. Active preparation of the patient is begun two days before the operation and carried out after the plan of all abdominal operations.

The greatest danger as a result of this operation is infection,—not of the peritoneal cavity but of the abdominal incision. While infection of the abdominal cavity is extremely rare with our perfected technic, and with the evidently strong resisting power of the healthy peritoneum, infection in the abdominal incision does occur more or less frequently with the best of operators who perform a large number of operations. Suppuration in the abdominal incision is particularly unfortunate in these cases, not only because the abdominal wall is weakened and hernia becomes possible, but because the infection is very liable to extend down the suspension sutures and produce a dense adhesion of the uterus to the abdominal wall, resulting in a fixation of the uterus rather than the suspension aimed at.

Experience and laboratory experiments leave no doubt that this infection usually occurs from the hands of the operator or his assistants, or from the skin of the abdominal wall of the patient. The staphylococcus albus, lying in the deeper layers of the skin, escapes disinfection and acts as the exciting cause in the majority of cases. The use of boiled rubber gloves by all those taking part in the operation I consider a great advance, in this operation especially, where vaginal work precedes the operation and haste may prevent the proper redisinfection of the hands. On account of the danger of the gloves tearing, the hands should be thoroughly disinfected previous to putting them on.

Preliminaries to the Operation.—The patient being anesthetized (ether is preferred), a careful vaginal examination is made under these favorable conditions to verify the diagnosis and, if necessary, reconsider the choice of operation. The plastic operations on perineum, vagina, or cervix, when indicated, are now performed.

The importance of this work as a preliminary step to all operations for the relief of displacements or prolapse of the uterus has been strongly insisted upon by Edebohls.¹

If we suspend a displaced or prolapsed uterus and omit to curet its cavity for the persistent endometritis commonly due to circulatory disturbance in these conditions, or if we neglect to repair a cervical tear which prevents proper involution of the uterus, or fail to remedy a relaxed vagina constantly dragging upon it, we leave the suspended uterus in a condition most favorable for relapse. The absolute necessity of this preliminary work is of the utmost importance for the perfect cure of displacements and prolapse of the uterus; its neglect in the latter condition is almost certainly fatal to success.

Steps of Operation.—The vaginal work being finished, the patient is placed in the Trendelenburg position with slight elevation, after a thorough final preparation of the abdomen has been made. The operator and assistants in the meantime thoroughly disinfect their hands and put on boiled rubber gloves.

¹ Edebohls, Geo. M.: "Combined Gynæcological Operations," Amer. Jour. Med. Science, Sept., 1892, vol. civ, pp. 262–280. *Ibid.*, "The Operative Treatment of Complete Prolapsus Uteri et Vaginæ," Amer. Jour. Obst., July, 1893, vol. xxviii, No. 2, pp. 68–74.

An incision 5 to 6 cm. long is made low down on the abdominal wall, in the median line, ending close to the symphysis pubis. The fascia covering the rectus muscle is cut through and the fibers of the rectus separated. I prefer this incision to that through the *linea alba*. The peritoneum is opened to the full length of the skin incision, and its edges are caught with hemostats. The index and middle fingers are passed through the opening, freeing any adhesions that may be found around the tubes and ovaries, and delivering each tube and ovary, in turn, through the abdominal incision for a careful visual inspection. The appendages are subjected to such treatment as may be required, such as igni-puncture, plastic operations, or complete removal. A wise conservatism should be exercised in dealing with these organs.

Returning the adnexa to their positions, the two fingers now discover the fundus of the retroflexed uterus and break up surrounding adhesions, either by cautious tearing, or, if firm, by cutting. When entirely free, the fingers, hooked behind the fundus of the uterus, bring it up into the abdominal incision in an anteflexed position. This step may be assisted at times when the abdominal walls are thick and the uterus low down in the sacral curve, by catching either round ligament with forceps and pulling the uterus with these; at the same time the fingers are used to elevate the fundus from behind.

The uterus is attached to the abdominal wall with two or three silk sutures. Rolling out the parietal peritoneum on one side with the hemostat clamped opposite the fundus, the first stitch is inserted 1 to 1.5 cm. from the edge of the incision and emerges 8 to 10 mm. from its insertion. The needle is now carried transversely through the posterior uterine wall 1 to 2 cm. below and posterior to a line connecting the insertion of the tubes into the uterus, including uterine tissue 3 to 4 mm. in depth. The peritoneum of the abdominal wall on the other side is similarly transfixed at a point directly opposite the first insertion. The second suture, passed similarly to the first, is inserted 1 cm. above it in the abdominal wall, and the same distance below it on the posterior uterine wall. A third stitch is sometimes necessary if the uterus is very heavy and its walls friable, or if there is considerable dragging on the stitches. The stitches are now tied and cut close to the knots.

An examination of the operation should now show the uterus well anteflexed and held firmly against the abdominal wall. The omentum is drawn down under the incision after the toilet of the peritoneum is completed and before the abdominal wall is closed.

Closure of the Incision.—The peritoneum and muscle are brought together separately with a continuous stitch of No. 1 cumol catgut. Interrupted silkworm-gut sutures, with needles on either end, are passed from within outward, taking in aponeurosis, subcutaneous areolar tissue, and skin. Before tying the interrupted stitches the fascia is further reinforced by a continuous suture of No. 1 cumol catgut.

In very thin patients, when a short incision has been made, I adopt the intra-cutaneous stitch for the skin, omitting the interrupted silkworm-gut sutures.

After-treatment.—Except in a few particulars the after-treatment in these cases is the same as that followed in other abdominal operations. Care should be exercised in lifting these patients from the operating table to the stretcher and from the stretcher again to the bed, in order that the suspension sutures shall not be torn from their moorings.

The bladder should be emptied every three or four hours for the first four days, either voluntarily or by catheter, and thereafter every four to six hours. Noble has seen the suspension sutures torn out in two cases from an overdistended bladder. For this reason he uses a drainage catheter for two days.

The patient should not be allowed to sit up in bed until three weeks after the operation. She may be carefully turned on her side after the first forty-eight hours for the relief which this gives.

The abdominal stitches are removed, if intracutaneous, on the tenth day; if interrupted, on the fourteenth day. If the cervix has been repaired preliminary to the operation, the cervical stitches should be left four or five weeks to allow good union to occur between the uterus and the abdominal wall, and care should be taken in their removal not to drag the cervix. A very slight traction may at this time tear the uterus from its attachment.

The patient on getting out of bed should be supplied with a good abdominal binder, which should be worn at least six months, and she should be admonished to refrain from hard work for the same period of time.

CHAPTER XIV.

OVARIOTOMY.

BY ALEX. J. C. SKENE, M.D.

CLINICAL HISTORY AND DIAGNOSIS OF OVARIAN TUMORS.

The growth of ovarian tumors is slow, as a rule. An ordinary cystoma requires about three years to attain what may be called full size, that is, about thirty-five to forty pounds in weight. Dermoids grow more slowly at first, while glandular and papillary cystomata grow faster in some cases. In the clinical history of ovarian tumor the fact is that subjective symptoms are often absent, the patient being unconscious of the tumor until it becomes apparent by the increased size of the abdomen. But, while cases occur without noticeable symptoms, the majority of patients suffer from some pain and discomfort, and more or less derangement of the functions of the ovaries, and occasionally some disturbance of neighboring organs. The symptoms differ in the different stages of the growth of the tumor. In the first stage, while the tumor still occupies the pelvic cavity, the patient may have a feeling of fullness in the pelvis, and pelvic tenesmus on standing or walking; pain is also present in the affected side, the severity of which varies greatly. In some it is only sufficient to attract the attention of the patient at times, but is not acute enough to prevent her from performing her ordinary duties. When the pain is quite severe and accompanied with well-defined tenderness, disabling the patient to some extent, there is usually some inflammation to account for it. Along with this there is ordinarily some constitutional disturbance indicative of the local affection. In quite a number of cases there is pain in the ovary for a few days at or just before the menstrual period, or midway between the periods.

It has been supposed that this kind of intermittent pain is due to ovulation occurring in the morbid ovary. When the pain occurs in the intermenstrual period, it is presumed to be caused by some imperfection in the maturation of the ovule; and, when it comes on about the menstrual period, it is probably due to the process of rupture of the Graafian vesicle. Menstruation is occasionally deranged. While one ovary is affected, the other may be normal, and, so far as the ovaries influence menstruation, there is no change, and the uterine function goes on in the usual way. This is sometimes the case when both ovaries are affected. Then it would appear that while a part of the ovarian tissue is morbid, there still remains enough that is normal to perform the function and maintain the ovarian influence upon menstruation.

Ovarian pain at the menstrual period is easily mistaken for dysmenorrhea. Irregularity or suppression of the menses is, I believe, the most common derangement.

Profuse and too frequent menstruation occasionally occurs, but either of these derangements may be due to some constitutional condition or uterine affection, which may accompany the ovarian tumor. When the ovarian tumor attains considerable size, and is yet not large enough to rise out of the pelvis, it may cause displacement of the uterus or bladder, and give rise to symptoms peculiar to these displacements. It is not often that these cause sufficient suffering to lead the patient to seek relief at the hands of the gynecologist. When the left ovary is the one involved there may be some disturbance in the action of the rectum.

The important fact still remains that, in the first stage of cystic tumors of the ovary that are uncomplicated, the symptoms do not afford any reliable guide to the nature of the affection.

In the second stage the tumor occupies the lower part of the abdomen and is noticed sooner or later by the patient. If the pedicle is short, the enlargement may be on one side; usually it is central, or nearly so, when first noticed. As the tumor increases, the weight and pressure cause discomfort. This is likely to be felt earlier in those who have not borne children than in those who have. In nulliparæ the abdominal muscles do not yield so readily to accommodate the tumor. Slight pains, recurring at intervals, and tenderness are common symptoms, and are usually due to tension of the cyst wall from rapid increase of the contents. During such pains the tension of the cyst is evident, and the pain subsides when the cyst becomes flaccid. If inflammation of the cyst or portions of the peritoneum occurs, there are, in addition to acute pain and tenderness, some constitutional symptoms, such as fever, rigors, and, if the inflammation is extensive, deranged digestion, loss of flesh, and hectic fever may follow. These symptoms indicate inflammation which will produce adhesions, especially if the peritoneum is involved; but extensive adhesions may take place without there having been at any time well-defined symptoms of circumscribed peritonitis. Obstinate constipation, flatulence, and irregular attacks of intestinal colic occur when adhesions of the intestine have formed.

In the third stage, when the tumor begins to make strong pressure upon the abdominal and pelvic viscera, another class of symptoms appear. Deranged digestion, impaired nutrition, difficult breathing, distressing weight, dragging on the abdominal muscles, together with pain and tenderness, may all supervene. Some of the symptoms which characterize the first stage disappear in the second, and often recur in the third. Pressure on the bladder may cause frequent urination, and the bowels may become obstinately constipated. Paroxysms of severe pain in the limbs and abdomen and edema of the legs may occur from obstructed circulation.

The patient becomes emaciated, weak, and sometimes hectic, but not, as a rule, cachectic in the benign forms of ovarian tumors.

Physical Signs.—In the first stage the bimanual examination of the pelvic contents is all that is necessary. This gives about all the information which can be obtained, except in obscure cases where it may be necessary to examine by rectum. Occasionally, when the parts are tender and resisting, it is necessary to give an an-

esthetic in order to make a satisfactory examination. The method of searching for small ovarian cysts in the pelvis is to pass the finger high up laterally and fish for the ovary from above downward, making the sacrum act the part of the abdominal hand in a bimanual examination. Where the tumor has obtained any considerable size, the bimanual touch gives the most satisfactory evidence. The tumor, caught between the fingers of both hands, can be outlined, and its character and relations to other pelvic organs ascertained with a tolerable degree of accuracy.

In the early stage the cyst is usually found on one side of the pelvis, or else in the sac of Douglas, exactly behind the uterus, or a little inclined to one side. It is usually soft and slightly yielding to the touch, sometimes globular and smooth of surface, or else globular in the main, with some irregular projections. These irregularities are due to the presence of small cysts or a portion of the ovary that remains normal.

This examination determines the fact that there is a neoplasm, and that it is possibly cystic, but affords no direct, positive evidence regarding the structure of the tumor. It is necessary, on this account, to resort to the method of diagnosis by exclusion.

Diagnosis in the First Stage.—The first question asked when a tumor is found in the pelvis is, Is it ovarian or not? There are many affections which present symptoms and signs resembling cystic tumors of the ovary. Those which most nearly approach them in character are dilation of the Fallopian tube from hydrosalpinx, parovarian cysts when small, extrauterine pregnancy, pregnancy in a bicornute uterus, small pedunculated subperitoneal fibroids of the uterus, fibroid tumor of the ovary, and in a less degree pelvic hematocele, pelvic peritonitis, and cellulitis.

Fecal accumulations in the upper part of the rectum and backward dislocations of the uterus have also been mentioned as simulating ovarian tumors, but these can be so easily differentiated that they need only be named in this connection.

Dilatation of the Fallopian tube may be distinguished from a cystic ovary by its oblong shape; and sometimes, when the tube is low down in the sac of Douglas, the normal ovary can be felt above the tube by the bimanual touch. In case the dilatation of the tube is due to pyosalpinx, the history will tell of a previous inflammation, and the constitutional symptoms are usually more marked. In time the ovarian tumors will grow and rise out of the pelvis, while in case of a dilated tube there will not be any great increase in size, but there will be more local and constitutional disturbance. This difference in the progress of the two affections is the most reliable means of differentiation.

Parovarian cysts cannot be distinguished from ovarian when they are small, unless the ovary can be separated from the cyst, and shown to be normal. Fortunately it is not of great practical importance to distinguish the one from the other.

Extrauterine pregnancy presents signs which are usually typical,—a normal menstrual course, suddenly interrupted by cessation of the period, followed in a few weeks by continuous or intermittent bloody discharge, and often accompanied by

a great deal of pain in the affected side. An ovarian cyst of corresponding size would usually be too small to occasion any symptoms. Pregnancy in a uterus bicornis may be detected by finding the non-pregnant horn, and perhaps the ovary may be found on the side in question.

What is the character of the tumor discovered? is the next question in order. An ovarian tumor is likely to be mistaken for a fibroid of the uterus when it is very tense and adherent to the uterus by inflammatory adhesions. Here, again, time will determine, because the ovarian will grow faster than the uterine tumor, and will show its characteristics more clearly the larger it grows.

A fibroid tumor of the ovary cannot be distinguished from a tense ovarian cyst at this stage by physical signs, but the history will help materially in making a diagnosis, and, when the fibroid becomes large enough to rise out of the pelvis, its solid character will be easily made out.

Many cases of fibroma of the ovary are accompanied by an abundance of ascitic fluid. This phenomenon is rare with benign ovarian cysts or with uterine myomata. Malignant ovarian tumors, such as cystic adenocarcinomata and cystic sarcomata, cannot be diagnosticated, when they are small, with positiveness. The same is true of dermoids, papillomata, and adenocystomata. A dermoid cyst sometimes has a pultaceous feeling or pits on pressure. Papillomatous outgrowths upon the surface of an ovarian cyst may occasionally be recognized by palpation through the vaginal vault. Cystic adenocarcinomata and cystic sarcomata present no diagnostic characteristics on physical examination, but they are suggested by accompanying ascites, emaciation, and cachexia. The fluid in the peritoneal cavity usually contains blood. In doubtful cases this fluid may be examined, as it aids in a decided way in making a diagnosis.

Pelvic hemocele, pelvic peritonitis, and cellulitis may, after the acute stages of these affections have subsided, present certain physical signs, which may lead one to suspect an intraligamentous ovarian tumor. But the history of such affections will put the diagnostician on his guard.

Diagnosis in the Second and Third Stages.—By the time that an ovarian tumor has escaped from the pelvic to the abdominal cavity and attracts attention by its presence there, it will have attained a size equal to that of the gravid uterus at the fifth month of gestation. In patients of spare habit it may be noticed sooner, but quite as often it escapes notice until a much later period. The physical signs which are of most value to the diagnostician in the second stage are enlargement of the abdomen, especially of the lower portion; some irregularity in the form of the abdomen, one side being larger than the other, and the lower being larger proportionately than the upper; the tumor is well defined and movable in the cavity of the abdomen, most freely from side to side. It is elastic and fluctuating, the fluctuation extending through the whole tumor if monocystic, while if polycystic the fluctuation may be limited to sections of the tumor. The tumor does not change its form to any extent when the position of the patient is altered, neither does the form of the abdomen change. It is attached to the pelvic organs, and if drawn up will drag

the broad ligament and uterus with it; but this is much less true than in the case of a pedunculated fibroid. The increase in size may be uniform, the two sides being alike, or one side may be larger than the other, and in some cases there is an irregularity of outline of the tumor which gives a nodular appearance upon inspection which is also apparent to the touch. A tumor large enough to be noticeable in the abdomen is usually in the center, and when it is eccentric it is because of adhesions, as a rule.

The irregular outline or nodular appearance is indicative of a multiple or multilocular tumor. By palpation the tumor can usually be distinctly outlined. This is always the case, unless the tumor is very flaccid and there is much fat in the abdominal walls, or the bowels are distended, but it is rare that these three conditions are found together. By grasping the tumor in both hands it can be moved from side to side in the abdominal cavity. It can be felt sliding about under the abdominal wall. By inspection the mobility can be detected by causing the patient to take deep inspirations and expirations, which will cause the tumor to move up and down. The vaginal touch may detect a portion of the tumor in the pelvis or may show that the round globular mass rests on the pelvic brim. The uterus can be made out, in a large number of cases, to be normal and not directly connected with the tumor, although it may be displaced. Beyond this the touch per vaginam only gives valuable negative evidence. Palpation also shows that the tumor is clearly outlined and easily distinguished from the neighboring organs in some cases. Percussion assists in outlining the tumor when it is not clearly defined to the touch owing to its flaccid condition.

The consistence can be determined by palpation, whether solid and very hard, solid and soft, or fluid and fluctuating. If the tumor is a monocyst and is large enough to touch the walls of the abdomen on both sides, diametric fluctuation can be obtained if the contents of the cyst be markedly fluid. If the tumor is divided into several sacs, fluctuation can only be obtained by palpating sections of it. In case the fluid is semisolid and does not give a clear wave on percussion, fluctuation may be produced by placing the fingers of both hands upon the tumor some distance apart and by making pressure with the fingers of one hand, the contents of the cyst will be pressed under the fingers of the other,—that is, fluctuation by displacement is obtained.

The fact that fluctuation is limited is most valuable evidence that the fluid is encysted. Further evidence of this is also obtained by the fact that the tumor does not change its form when the position of the patient is changed. By turning the patient first on one side and then on the other, it will be observed that while the tumor may gravitate to the lower side it does not change its form.

The physical signs of ovarian and other abdominal tumors obtained by exploratory celiotomy are, of course, peculiar to each. The description of these appearances may help one to recognize such tumors when seen and felt through the abdominal wall, but much experience in observation is necessary to tell what a tumor is when one sees it in the abdominal cavity. The ambitious and rash may

open the abdomen to make a diagnosis, and be unable to recognize that which they find.

There are certain affections and conditions which resemble to some extent ovarian tumors in the second stage. The chief of these are fat and intestinal flatus; pregnancy, normal and pathologic; neoplasms of the uterus, such as fibroids and fibrocysts; distended bladder; fecal impaction; encysted fluid in the peritoneal cavity, *e. g.*, in tubercular peritonitis; cysts of the kidney, liver, or spleen; enlargement and displacement of the spleen, kidney, or liver; cancerous disease of the ovaries or of any of the abdominal organs, omentum, or abdominal glands; and parovarian cysts.

Large accumulations of adipose tissue in the abdominal wall and omentum may suggest the presence of an ovarian tumor, but can be excluded by placing the hands upon the sides of the abdomen and bringing them toward each other so as to gather up the walls in a fold and separate them from the viscera, thus showing the absence of any tumor. In such cases percussion is of great value; a normal or tympanitic note is obtained, instead of the flat note found in cases of ovarian tumor.

Pregnancy, in its normal state, differs greatly from an ovarian tumor in all respects, except the fact that both the gravid uterus and the tumor occupy the abdominal cavity. Still, a number of cases having been reported in which an error in diagnosis was made leads me to say here that at the present time such a mistake can only be made through want of knowledge or lack of attention. I need not give the differential diagnosis between ovarian tumors and normal pregnancy; the symptoms and signs of the former have been given, and those of the latter can be found in any text-book on obstetrics, if not already familiar to the reader, and they are so very different that by contrast the diagnosis can be made.

Extrauterine Pregnancy.—This usually comes up for diagnosis in connection with the first stage in the growth of ovarian tumors, as has already been stated. It is only the abdominal variety which in any way resemble ovarian tumors in the second stage. The signs of a living child in the abdomen are so perfectly diagnostic that they can hardly be mistaken. In case the child is dead, more difficulty might be experienced in making a diagnosis. The history of the case and ballottement, or the ability to move the dead child in the sac, will usually suffice, but, if there is still a doubt, the bones of the child can be exposed with the X-rays and the diagnosis made perfectly sure.

Ruptured Ovarian Cyst.—This and the extensive adhesions which follow such an accident resemble in several respects ventral pregnancy after the death of the child, both in history and in physical signs, and I can understand that it might be impossible to discover the exact nature of the trouble without the aid of laparotomy. Fortunately, under these circumstances it would be perfectly right to employ this method of making the diagnosis, because it is part of the appropriate treatment in either case.

In the cases of abdominal pregnancy that I have seen the diagnosis was very easy;

so much so that no one with any experience could have made the mistake of suspecting ovarian tumor.

Uterine fibroids and fibrocysts, when large, present some of the evidences of ovarian tumors. The position of the tumor in the abdomen and its shape and mobility are the same as those of some ovarian tumors, and these are the only resemblances.

In the fibroids, the uterus is enlarged as shown by the touch and sound. The tumor is solid and is intimately connected with the uterus; in fact, forms a part of it. In the majority of cases the cavity of the uterus can be probed and will be found enlarged in case the tumor is uterine, while it will not be if the tumor is ovarian.

The distended bladder has been mistaken for a cyst of the ovary, but only at a first examination or by one not capable of taking care of such cases. When the bladder is overdistended there is incontinence, the urine coming away constantly, or in spurts when the patient moves. This leads the unskilful medical attendant to suppose that the bladder must be empty and that the tumor is an ovarian cyst, but the catheter readily settles the question, and it should always be used in cases with such histories.

Fecal impaction has always been mentioned in books as one of the conditions which might be mistaken for an ovarian tumor, but I have not considered such a thing possible. The irregular form and solid character of the fecal mass differ in every respect from ovarian tumors of every variety.

Encysted dropsy of the peritoneum is a rather rare affection and occurs in the progress of tubercular disease, as a rule, or follows an attack of peritonitis. The physical signs differ, in that the fluctuation is not so general as in ovarian cyst, and the fixation is complete. The surface of the abdomen is not so prominent as in the case of an ovarian cyst, but often has irregular depressions as well as elevations. The general health is greatly reduced early in the progress of the disease. Nutrition is markedly impaired and there is often hectic fever, in case there is encysted pus.

The vaginal examination is often quite sufficient to settle the diagnosis by showing that the pelvic organs are normal and can be outlined and separated from the mass in the abdomen.

In other cases, as has been so graphically pointed out by Murphy, Mayo, and various others, the tubercular peritonitis is due to caseous tubercular material being extruded into the abdominal cavity from the fimbriated ends of the Fallopian tubes. In such cases pelvic examination will reveal thickened tubes and often dense pelvic adhesions.

Enlargement and Cysts of the Liver, Spleen, and Kidneys.—In all of these the diagnosis, so far as concerns the exclusion of ovarian disease, can be easily made if the cases are seen early or a correct history can be obtained. In the diseases in question the enlargement begins above and on one side, and, as a rule, is fixed there from the beginning, and the pelvic organs can be separated from the tumor above, and proved to have no connection with the morbid growth. Retroperitoneal tumors distend-

ing the abdomen and originating from the kidney or one of the pelvic organs, are usually resonant or tympanitic on percussion, because of the overlying intestine. These diagnostic facts will suffice in most cases to settle the question, but additional evidence can be obtained from the general history of the growth and its effects upon the general health, also the composition of the fluid in the cysts, which might be obtained by aspiration in doubtful cases, if this should be deemed desirable.

Parovarian cysts are not easily differentiated at all times. They are very rare as compared with ovarian cysts; they grow slowly, and occur mostly in young persons. The general health does not suffer, as a rule. The physical signs differ in no way from those of the ovarian monocyst, except that the fluctuation is more distinct and the fluid differs, being clear like water and without albumin. Tapping, or rather exploratory aspiration, could be employed to settle the diagnosis, were this desirable. Removal of the growth is indicated in either case, therefore an exact differentiation is seldom of great importance.

Affections Which Resemble Ovarian Neoplasms in the Third Stage.—

These are ascites and uterine fibrocysts. The first mentioned, ascites, is the most likely to be mistaken for ovarian cyst. The chief points of difference in history are that ascites is, as a rule, preceded by some acute disease or general ill health suggestive of some disease of the liver, heart, or kidneys. There is anasarca also in most cases of ascites, and the patient is generally anemic early in the progress of the disease. The enlargement of the abdomen comes on rather suddenly and is not confined to its lower part; that is, it is not circumscribed. The history of ovarian cyst in growth and general constitutional symptoms is almost the reverse of ascites.

The physical signs of ascites differ from those of ovarian cyst chiefly in that the fluid in ascites changes its position with every change in the position of the patient. When the patient is placed upon her back the abdomen is symmetric and flat; in the erect position, the lower portion bulges from the gravitation of the fluid, and the same change in the position of the fluid occurs when the patient is turned toward either side. With these changes in the position of the fluid there is a change in the resonance on percussion. The flatness is found at the most dependent part, while the resonance is found at the upper part.

There is another exception to the rule that in ascites there is always resonance at the highest point of the abdomen whatever the position of the patient may be, and that is when the tension of the abdomen is extreme, and the mesentery is not long enough to permit the intestines to rise to the top of the fluid while the patient is upon her back. There is also a difference in the fluids, which gives some help in diagnosis, in case aspiration is practised, as it may be in doubtful cases.

Uterine fibrocysts seldom attain sufficient size to resemble ovarian cysts, but occasionally they do so. The fibrocysts of the uterus more closely simulate the ovarian cystic tumors than the fibromata. The difference in the history, and the fact that the uterus is involved in the tumor in fibrocyst and free in the other form, are the chief points of difference. This subject was discussed in treating of the

diagnosis in the second stage of ovarian tumors, and need not be repeated in full in this connection.

Finally, in regard to diagnosis there are two classes,—one in which a complete diagnosis can be made, and one in which the diagnosis is incomplete. In the one, the nature and composition of the tumor, its relations to the abdominal and pelvic organs, and the extent and location of its attachments can be clearly determined; in the other, which is incomplete, there may be sufficient evidence to warrant operative treatment or a full assurance that the case is not amenable to surgical treatment, while the exact composition of the tumor may be doubtful. The first, or complete, diagnosis can be made from the usual physical signs and history. The incomplete diagnosis may be made complete by surgical means, such as aspiration or celiotomy.

COMPLICATIONS WHICH MAY OCCUR IN OVARIAN CYSTOMATA.

The complications which are of the most interest to the surgeon are adhesions to the pelvic and abdominal organs and to the walls of these cavities; twisting of the pedicle; dragging of the pedicle; displacement of the pelvic organs; perforation or rupture of the cyst wall; necrosis of the cyst wall; inflammation or suppuration of one or more of the cysts of the tumor, and intraligamentous development of the tumor.

Adhesions to the Pelvic Peritoneum.—These take place when the tumor is small and are easily detected by the history of a previous inflammation and by the fixation of the tumor observed by bimanual touch.

Adhesions to the Uterus and Bladder.—These are diagnosticated by the fixation or inseparable condition of the tumor and these organs in the first stage of the tumor's existence and the derangement of the function of the bladder. The upward displacement of the bladder and uterus which takes place when the tumor ascends into the abdominal cavity indicates the presence of these adhesions.

Adhesions to the Abdominal Wall.—These are detected by moving the tumor from side to side and observing that the abdominal wall moves with the tumor. In tumors of moderate size there is slight up-and-down motion on forced respiration which is arrested in ventral fixation from adhesions.

Adhesions of the omentum cannot be detected, but may be suspected if the tumor is partially fixed while adhesions to the abdominal wall are absent.

Intestinal adhesions cause partial obstruction, which is indicated by tenderness, constipation, flatulent distention, and frequent attacks of intestinal colic. These, with a previous history of circumscribed peritonitis, lead to a fairly accurate diagnosis.

Twisting of the Pedicle.—A partial or slight twist of the pedicle may cause no trouble and pass unnoticed, but when a sudden twisting takes place and is sufficient to constrict the vessels in the pedicle, acute and severe pain in the tumor appears, followed by all the constitutional symptoms and local signs of inflamma-

tion of the tumor. In some of the most marked cases there has been shock, caused possibly by hemorrhage within the cavity of the tumor. This condition is liable to be mistaken for general peritonitis from perforation of a cyst, but the facts that the tumor remains tense and the tenderness and pain are limited to the tumor are sufficient to base a presumptive diagnosis upon. At any rate, the evidence is sufficient to show that some grave lesion has suddenly occurred in the tumor and indicates that immediate surgical treatment is called for.

Dragging of the Pedicle.—This condition occurs generally in those who become pregnant during the presence of an ovarian tumor.

The symptoms are the same as in twisting of the pedicle, but so much less severe and so ill defined that an accurate diagnosis cannot be made in all cases.

Perforation of the Cyst Wall.—This results from ulceration, beginning in the inside of the wall. Small perforations occurring at a point on the tumor in contact with the peritoneum generally cause a circumscribed peritonitis with the pain and limited tenderness indicative of that condition. In a larger perforation, and if the contents of the cyst are septic, general peritonitis is suddenly established. The pressure being relieved, the tumor becomes less tense and defined in outline.

Rupture of the Cyst.—This accidental complication is easily diagnosed. There is sudden collapse of the tumor and all the physical signs are changed to those of abdominal dropsy. Generally there is some degree of shock followed by acute pain and all the signs and symptoms of peritonitis. It is fortunate that the history is so well defined and diagnostic in view of the fact that many of those who suffer from this complication can only be saved by prompt operation.

Necrosis of the Cyst Wall.—This occurs so gradually that it passes unnoticed if ovariectomy is performed soon after it takes place. When it exists for a length of time—several weeks—the patient's health is affected as in a mild or subacute septicemia. This being the only evidence that necrosis has taken place, I have found that it is not possible to make an early or positive diagnosis until the tumor is exposed by celiotomy.

Cystomatitis.—This is an inflammation of one or more cysts of the tumor, and is usually subacute. There is increased tenseness of the tumor or the cyst involved, with subacute pain and tenderness. That is to say, the pain and tenderness are less acute than those of peritonitis, which suggests to the diagnostician the nature of the complication. Inflammation of the cyst may be followed by suppuration.

Intraligamentous Cystomata.—Because of the special difficulties encountered in the removal of this class of cystomata I have deemed it expedient to class it with complications, for as such it must be considered in relation to diagnosis and treatment. The symptoms of ovarian tumors situated in the broad ligament are the same as those occupying the usual position, excepting that the intraligamentous variety is attended with more distress or discomfort and the uterus and bladder are more likely to suffer from functional derangement. The physical signs obtained by bimanual examination in the first stage are as follows: The tumor is lower down

and further forward in the pelvis, and extends laterally toward the pelvic wall more than is true of typical ovarian tumors. As the tumor grows it pushes the uterus to the opposite side and is at all times fixed in the pelvis, but not adherent to the pelvic wall, as is true of the mass due to pelvic cellulitis. With this latter exception the physical signs of this tumor and of unilateral pelvic cellulitis are much the same. Sometimes the tumor before rising out of the pelvis burrows down and behind the rectum. When this takes place it proves positively that the tumor is subperitoneal and hence intraligamentous.

In the second stage, when the tumor occupies the abdominal cavity (it seldom, if ever, entirely leaves the true pelvis) it is held firmly below so that it cannot be moved. This fixation below, in the absence of evidence of adhesions, is quite characteristic. The uterus usually remains dislocated laterally, though in rare instances it returns toward its central position. Not infrequently it is carried up into the abdominal cavity along with the tumor. In such cases the uterus is usually much elongated.

Intraligamentous uterine fibromata resemble somewhat in physical signs this form of ovarian tumor, but the slow growth, the menorrhagia and the dysmenorrhea (which the fibroid of the uterus frequently causes), and the cystic character of the ovarian tumor usually make the diagnosis clear.

INDICATIONS FOR OVARIOTOMY.

Ovariectomy is indicated when a neoplasm or tumor of the ovary is discovered, and the operation should be performed when the surgeon is satisfied that the tumor is growing and impairing the health or usefulness of the patient. In the early history of ovariectomy the rule was to wait until the patient's suffering and the size of the tumor endangered her life. This was at the time when the mortality from ovariectomy was very great. Now that the danger is trivial there should be no unnecessary delay. In fact, it is unsafe to wait, because complications are likely to arise that lower the chances of success.

Patients who do not suffer sometimes decline to be treated, electing to wait in spite of the advice of the surgeon. They have a right to their own way, and while it may not be the best, it is unwise, as it is generally fruitless, in such cases, to urge operation.

Contraindications for Ovariectomy.—Ovariectomy should not be undertaken when the following conditions are present: Any organic disease of the general organization that would make it hazardous to give an anesthetic;¹ when the vital forces and general nutrition are reduced so that there is no chance of the patient being able to stand the operation or recover from the direct effects of it; when there is anemia in a marked degree, the red blood-corpuscles being below 15 or 20 per cent.; when there is extreme flatulent distention of the bowels; cases of malignant disease of the ovaries that are far enough advanced to have formed

¹ The operation can be carried out with local anesthesia in a large number of cases.

adhesions, and presumably in which other organs are involved.¹ A well marked inherited tendency to insanity or a previous attack, if not a contraindication, renders the prognosis grave, and the friends of the patient should be so informed before consenting to the operation. In times past the presence of inflammation in the pelvis or abdomen, such as circumscribed peritonitis, was a contraindication, but today this is considered to be an indication for immediate action, all other things being favorable.

THE PLACES BEST SUITED FOR OVARIOTOMY.

The modern hospital or sanitarium with all the best sanitary and hygienic conditions should be chosen for the operation whenever that is possible. The advantages possessed by such institutions are well known and need not be discussed here.

In order to maintain the best sanitary conditions in institutions for surgical cases special care is necessary in the admission of patients who are liable to bring with them the germs of contagious and infectious diseases. The system which I have adopted is as follows: A complete outfit of clean clothing is sent to the sanitarium the day before the patient arrives. This is conveyed directly to the sterilizer and thoroughly disinfected and put into a sterilized bag to await the arrival of the patient. On her arrival she is taken to a warm bath-room, completely undressed (her clothing put into a clean bag and sent to be sterilized), and thoroughly bathed. The kind of bath depends upon the condition of the patient as regards her strength. After the bath she is dressed in the garments that have been rendered sterile and she is then admitted to her room, when her treatment preparatory to the operation is begun.

When ovariectomy has, of necessity, to be done in a private residence in the city or country, every care should be taken to separate the patient from possible contagion and septic influences and to render her person and clothing and surroundings as surgically clean as possible. Boiling the clothing is next to steam sterilizing in efficiency; and the cleansing of the rooms can be fairly well performed by means of the recent methods of disinfection. This will be referred to later. Certainly, much more time and trouble must be taken to obtain comparative safety when operating in private houses, to say nothing of the difficulties of securing proper after-treatment. All this tends to show that better results are obtained by operating in a hospital.

THE MEDICAL TREATMENT PREPARATORY TO OVARIOTOMY.

This subject having been fully described in relation to abdominal operations in general, I shall only mention in brief some items of treatment that have special relations to ovariectomy.

¹ In cases of papilocystomata of the ovary with secondary peritoneal implantation the peritoneal resistance seems greatly lowered, and general peritonitis is prone to develop speedily even after a simple operation.

Having carefully investigated the patient's condition and determined that there are no organic diseases present to contraindicate the operation, all functional derangements and impaired nutrition should be corrected. One meets not infrequently with urgent cases which must be taken as they are and operated upon at once. The majority of cases, however, can be kept under observation long enough to obtain a clear idea of their characteristics and requirements in the way of preparatory treatment.

The Nervous System.—The state or condition of the nervous system should be investigated, and, if found defective, should be corrected as far as possible. Many patients leave home to be under the care of a special surgeon, and this, together with the dread of operation, often deranges the nervous system. Time should be given for the patient to become accustomed to her surroundings and to gain confidence in the nurse and the surgeon. During this time the true state of her nervous system can be ascertained. If she is sleepless and depressed, relief should be given by nerve sedatives and tonics. Quite often the deranged state of the nervous system is due to impaired nutrition, and will be relieved by improving the digestion. Occasionally the nervous trouble is primary, and requires direct attention. Opium in small doses is most reliable in producing sleep and relieving depression, but in some it deranges digestion and nutrition, and on that account other remedies should be employed. Sulphonal, veronal, and trional do remarkably well as sleep-producers in certain cases. Sometimes they produce depression the following day, and in that case chloralimid does well as a substitute. It produces the desired result in those who are not kept from sleep by severe pain.¹

To restless, anxious patients, who find the days very long even when they sleep at night, and on whom opium does not act well, I have given large doses of lupulin and camphor or small doses of cannabis indica. If these do not answer, opium should be tried, so that if it becomes necessary to use it in the after-treatment the surgeon knows how far to depend upon it and what effects may be expected.

The nutritive system requires attention in all patients. Those who have not been long affected need very little treatment, except, perhaps, to relieve constipation and subacute indigestion. Those in whom the tongue is coated, the bowels sluggish, the appetite variable, and the kidneys act imperfectly can be relieved by a few small doses of the mild chlorid of mercury, followed by a saline laxative. If this does not clear the tongue, improve the state of the stomach, and increase the action of the kidneys, the treatment should be repeated in a few days. The more advanced cases, in which there is general malnutrition as well as impaired digestion, require gastric sedatives, such as bismuth or cerium. These may relieve the irritation and improve the appetite. In such cases a tonic laxative like *nox vomica*, *bella-donna*, and *rhubarb* will relieve constipation far better than salines.

The objects in view in the management of the bowels are threefold—to clear

¹ Many patients are only rendered more nervous by delay, and the longer the period before operation the more they magnify their ailment and the greater the nervousness. In such cases prompt operation is best.

out the canal; to establish as far as possible normal secretion; and to remove the causes of flatulence whatever they may be.

The selection of a cathartic to be given just before the operation is important. Castor oil is the best, especially if there is constipation or a suspicion of fecal impaction. The only difficulty is that many patients strongly object to it. When it can be taken, it should be given two nights before the operation. This gives time for the oil to act, and also gives the bowels a chance to become quiet before the operation. The rectum should be washed out the night before the operation or early in the morning. In feeble patients who require a cathartic and yet are not strong enough to stand its action, I give half an ounce of castor oil and two drams of oil of turpentine. This is a most valuable preparation if the stomach will retain it. In fact, this is the only cathartic that will act thoroughly in weak, debilitated patients without causing depression. The dose of turpentine is large, but if less is given it will affect the kidneys and fail to some extent as a cathartic. This may be called a tonic, or stimulant and cathartic. A similar effect may be obtained by giving six grains of rhubarb, one grain of compound extract of colocynth, one grain of camphor, and a tenth of a grain of extract of belladonna, in pills. There is little depression following the action of this, but it is not so certain in its action as turpentine and castor oil.

To those who cannot take either oil or pills without having their stomachs upset, I give one or two teaspoonfuls of calcined magnesia and half a teaspoonful of charcoal, followed in a few minutes by a glass of warm lemonade. This empties the bowels and relieves flatulence very thoroughly. This is given in the morning of the day before the operation, the object being to have the bowels quiet and empty at the time of operation.

The condition of the kidneys should be carefully noticed, especially with regard to the elimination of urea. If any functional or subacute disease of the kidneys is found, it should be carefully treated. As a rule, in acute or subacute nephritis sufficient relief can be obtained in time to warrant the operation. Extra efforts should be made so shorten the time of operation in patients suffering from nephritis. I have for a long time made it a rule to examine the urine always before giving an anesthetic, and believe that it should be the invariable practice to do so. I refer to that matter here because I have found many who do not think it necessary.

The heart is often deranged in its function from pressure or indigestion, and it nearly always improves under treatment. When there is time, I order muscular exercise as well as remedies to improve nutrition, and find that much improvement in the heart action follows. Organic heart disease, other than extreme hypertrophy, moderate dilatation, or aortic stenosis or insufficiency, does not deter me from giving an anesthetic and operating. Many patients having disease of the mitral valves take ether very well.

IMMEDIATE PREPARATION FOR OPERATION.

When there is marked debility, with weak heart, digitalis and nux vomica should be given the preceding day. Especially is this necessary when the operation promises to be a desperate one. The number of doses should depend upon the effect. As soon as the heart action is noticeably improved the drugs should be withheld. If alcoholic stimulation is required before or during the operation it should be given by the rectum.

The food, for forty-eight hours before the operation, should be of the most nourishing kind, and at the same time easily digested, or else it should be artificially digested.

The time to operate is, as a general rule, midway between the menstrual periods. An exception should be made in cases of menorrhagia and dysmenorrhea in which there is an improvement in the strength toward the period of menstruation. Advantage should be taken of this by operating immediately before the menses.

The morning is by far the best time to operate. The patient is then at her best and the stomach is empty. The latter is a condition very necessary to the taking of an anesthetic. This would not be referred to here were it not for the fact that a great many surgeons in this country operate late in the day. The patient suffers from anxious anticipation and becomes fatigued if food is not given; and if it is given, it is not, as a rule, either digested or absorbed, and the stomach acts badly during and after anesthesia under such circumstances.

THE OPERATION.

Opening the Abdominal Wall.—The incision should be $2\frac{1}{2}$ to 3 inches long, in uncomplicated cases, and in the median line, a trace of which can usually be seen in the form of a linea nigra. It should extend from half an inch above the depression which separates the abdominal wall and mons veneris upward the desired length. The first incision should divide the skin and subcutaneous fat down to the deep fascia. A white line, the linea alba, then appears and marks the junction or union of the muscles. When it does not thus appear it can be found as a fine cord between the recti, unless the wall has been long distended or greatly relaxed. In that case, the fascia should be divided obliquely or transversely a short distance, when it will be exposed, and the incision between the muscles made. The subperitoneal fat and cellular tissue are caught up with toothed forceps by the operator and assistant and divided down to the peritoneum, which is caught and drawn up in the same way and divided. Care should be taken to avoid the large veins which run vertically near the median line. When it is desirable to enlarge the incision two fingers should be passed up inside, the wall lifted, and blunt-pointed scissors used to divide the tissues between the fingers. In fat patients a longer incision is required, and when there are adhesions of the tumor to the abdominal wall it is necessary to make the incision farther up, to the point where the adhesions end.

Adhesions of the tumor to the abdominal wall complicate this part of the operation greatly, especially when they are old and firm. Recent adhesions are easily detected by one who is familiar with the appearance of recent exudates upon serous surfaces, and they are easily separated from the cyst wall with a knife-handle, finger, or sponge. Old adhesions so change the peritoneum and cyst wall in appearance that neither is recognizable with certainty. There is no subperitoneal fat left in these cases to guide one, so a careful dissection should be made by tearing, not cutting, the adhesions until the cyst wall is reached and recognized by its being more resisting than the exudate. The separation should be made toward a point where adhesion ends, if there is such a place, and continued all around the wound far enough to permit a portion of the sac to be drawn out of the wound during the process of tapping or emptying the cyst or tumor.

In abdominal dropsy the thickened and abnormally vascular peritoneum has been mistaken for adhesions, but in that condition the peritoneum protrudes into the wound and is blackish in color, conditions that when once seen can thereafter be recognized.

Evacuating the Cysts.—The most important thing to be accomplished in this procedure is to keep the cyst contents from escaping and coming in contact with the wound or the hands of the operator and assistants. Having tried all ways of tapping and found them all wanting in some degree, I now, when possible, aspirate. The trocar and cannula and the reservoir are the same in mechanism as those used for tapping the chest, only much larger.

The trocar when withdrawn past the escape tube acts as a valve to close the proximal end of the cannula, and should be tightly packed to prevent leaking. The trocar should be sharp at the point, but the edge next to the cannula should be dull so that the wound made may be smaller than the cannula. This and the aspirating suction prevent the escape of fluid by the side of the cannula, a mishap which often occurs, especially if the cyst wall is friable.

The trocar and cannula are plunged into the cyst at the highest end of the incision, or the space that is least vascular, the trocar drawn back and handed to the assistant, who at that instant opens the stopcock of the receiver. The cyst wall is seized with forceps between the cannula and left side of the incision. This is also handed to the assistant, who holds it and the trocar in his left hand and makes the necessary traction to withdraw the sac. The operator also applies forceps to the cyst wall and aids in making traction; at the same time he watches the cannula and keeps it in place.

Evacuating the Tumor in Complicated Cases.—In multiple cysts in which the contents of the sacs can be removed by tapping, the trocar and cannula are thrust into the nearest cyst and it is emptied in the usual way. The trocar is then pushed from the inside of the empty cyst into another sac, which in turn is emptied, and so on, until all are emptied. To do this safely the tumor should be steadied with the left hand while the trocar is used with the right, and this helps to make sure that the trocar goes into the sac and not into the viscera or the abdominal wall.

When the contents of the tumor are semisolid and will not flow through the cannula, the trocar and cannula should be removed and the abdominal incision increased in length until large enough to permit the delivery of the tumor.

Treatment of Adhesions.—Adhesions of the omentum and abdominal and pelvic viscera are treated after the tumor is emptied of its fluid contents. The omental adhesions are most easily tied while attached to the tumor, and that should be the rule, but if it is necessary to get the omentum out of the way before the operator has time to tie it properly, compression-forceps may be put on, and the whole wrapped up in a sterilized towel and left on the abdomen at the upper angle of the wound until the cyst is removed, when attention can be given it. It should then be tied in sections of about the width of two fingers and the sections should be tied together to keep the omentum from tearing.

Adhesions of the bladder to the anterior surface of the tumor can be stripped or sponged off if they are recent, but if they do not yield easily, the separation should be made by dissection, keeping close to the tumor to be sure not to injure the bladder which, by the way, is very easily torn when its walls are softened by being adherent.

When the bladder is set free it usually contracts and so reduces the raw surface that was adherent. This surface should be closed in by a fine continuous suture.

Keith treated adhesions to the bowels and mesentery by making traction upon the cyst and pressing against the adhesions with a sponge. In this way the adherent tissue can be pushed apart with less injury than in any other way, except when they are old and firm, and then they should be dissected off with the peritoneal coat of the cyst wall. Pulling upon adhesions should always be avoided, if possible. Sometimes when there are many adhesions high up, strong traction must be made, but it is dangerous practice and only to be resorted to when it cannot be avoided. Long bands of adhesions should be tied before being detached, and the following points should be observed: To have no tension upon these parts; to ligate as close to the tumor as possible, and make sure that all bleeding is stopped before letting go the parts. The bleeding coming from broad surfaces after adhesions have been separated may be controlled by placing sponges in the abdomen and making pressure for a time. When there are many adhesions high up in the abdomen, it is an advantage to find the pedicle, clamp it with forceps and divide it, and then remove the tumor from the pelvis first. When the adhesions are all separated and the tumor removed, the sponges which have been introduced should be removed and the bleeding vessels caught up and tied.

Adhesions to the rectum are the most difficult to manage, because being deep down in the pelvis they are hard to get at and the rectum is easily wounded. In fact, in bad cases the rectum will tear with less force than that required to separate the adhesions from the tumor. When the adhesions of tumor and rectum are close together and do not separate easily a part of the outer coat or the whole of the sac wall should be dissected off and left attached to the rectum. This portion of the sac wall should be trimmed off and its lining membrane destroyed and dried with the dome cautery, care being taken not to char the parts or use the heat high enough

to injure the rectum. I have many times found that I could deal with rectal adhesions better by treating the pedicle and dividing it first. This enables one to get at the adhesions from above and hence more easily. A point of cleavage is more readily found in this way of manipulating. Adhesions in this location occasionally



FIG. 298.—METHOD OF CONTROLLING BROAD LIGAMENT AFTER SALPINGO-OÖPHOROCYSTECTOMY. The vessels of the uterine horn have been tied with catgut. Two pairs of artery forceps grasp the ovarian vessels. After removal of the lower pair a suture is introduced in the resulting groove and tied.

involve the peritoneal covering of the ureter, and the operator should keep close to the tumor in separating them.

Since adopting this method of treating adhesions to the rectum I have had better success than in the old way.

Adhesions to the Vermiform Appendix.—The appendix is not very often



FIG. 299.—METHOD OF SUTURING THE BROAD LIGAMENT AFTER SALPINGO-OÖPHOROCYSTECTOMY.

The uterine horn and the ovarian vessels have been controlled separately by silk or catgut. Then a running suture approximates the peritoneum of the anterior and posterior peritoneal flaps along the entire area, the object being to leave no raw surface.

found adherent to ovarian tumors. According to my records it is more often found adherent in pyosalpinx. While it may be possible to separate such adhesions in some cases, it is far better surgery, in my opinion, to remove the appendix with the tumor.

Treatment of the Pedicle.—The tumor being freed

from all connection is lifted out of the abdominal cavity and a sponge or gauze pad is introduced through the wound to prevent the escape of intestines and protect the peritoneal cavity. A pair of compression forceps is applied to the pedicle as near to the broad ligament as desirable and another forceps is applied above the first one and the pedicle divided between them.

In controlling the pedicle interrupted sutures should be employed. There is less tissue in the bite of any one ligature and hence less liability of hemorrhage and a diminished possibility of necrosis and subsequent infection. First control the ovarian vessels with fine Pagenstecher thread and reinforce with catgut. Then use catgut for remaining and smaller vessels of the pedicle. Care should be taken to avoid puncturing any vessel in the pedicle. If this accident should by chance happen, split the peritoneum of the pedicle, turn out the clot, and catch the bleeding point free-hand and tie; otherwise infection or widespread thrombosis of the vessels may follow. An approved way of treating the stump of the broad ligament left after the removal of an ovarian cyst is illustrated in Figs. 298 and 299. As the tube is usually involved in the pedicle of a cyst, it is removed with the ovary. The ovarian vessels are compressed with forceps and the vessels of the uterine horn are tied with catgut before the pedicle is divided. The ovarian vessels are now

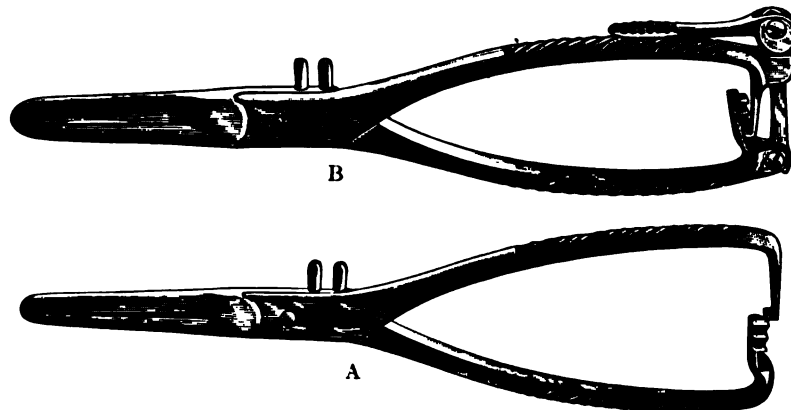


FIG. 300.—DOWNES' CAUTERY CLAMPS.

ligated and the exposed part of the broad ligament is covered by means of a running silk suture.

The method of treating the pedicle with the electric hemostatic forceps is as follows: A clamp forceps is selected to suit the size of the pedicle. For a small pedicle the one illustrated in Fig. 300, A, answers; for a larger one, the clamp forceps shown in Fig. 300, B, should be used. A little sterilized vaselin is sparingly applied to the inside of the blades to keep the instrument from adhering to the tissues. The instrument is applied to the pedicle at the point desired and closed to the first notch in the catch, and then a shield forceps (Fig. 301) is applied beneath the hemostatic clamp to protect the adjacent tissues from the heat and keep the stump from falling back into the pelvic cavity, when the clamp is removed. The electric current is turned on and the heat continued until the desired effect is produced. The time required for this with the Skene electric clamp is about two minutes; with the Downes instruments about forty seconds. The end of the pedicle projecting above is cut off close to the clamp. The clamp is then removed and the stump (still in the grasp

of the shield forceps) is inspected, and if all the vessels are not closed and the tissues glued together and dry, the clamp should be reapplied and heated under strong clamp pressure until satisfactory results are obtained. If only one vessel and a part of the tissue has escaped proper treatment these parts are caught in an artery forceps and heated until thoroughly mummified. The time required to apply the heat can be utilized by the operator to examine the other ovary and remaining pelvic organs. The shield forceps is then removed and the stump permitted to fall back into the pelvis.

One not accustomed to this method of arresting hemorrhage is likely to hesitate about letting go a pedicle stump treated in this way, being fearful of hemorrhage. I may say to such that my confidence in the method is perfect and based upon the fact that I have never, in a sufficient experience, seen any after-troubles whatever. If the stump appears (when the clamp or forceps is taken off) like a piece of parchment, is translucent, and the blood-pressure does not reopen the vessel, bleeding does not occur afterward.

Intraligamentous Ovarian Tumors.—The incarceration of an ovarian tumor within the folds of the broad ligaments I have classed with the complications of

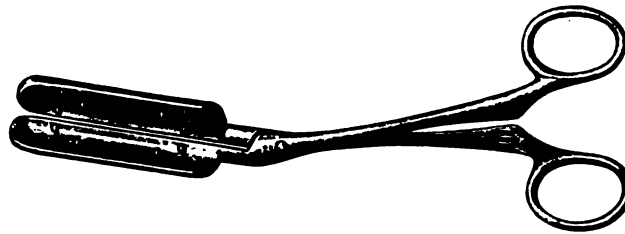


FIG. 301.—SHIELD FORCEPS.

ovarian tumors, and therefore give the methods of treatment or operation in such cases in this connection.

There are two kinds of intraligamentous tumors classified according to their position in relation to the broad ligament—those that burrow deep down in the pelvis and those that occupy the upper part of the ligament, and they require different treatment.

The thing to do first, after the abdomen is opened, is to make sure of the diagnosis. The distinctive characteristics of this tumor are that it appears more like a fibroma or pregnant uterus than an ovarian tumor, owing to the vascular ligament (peritoneum) which forms the outer coat or capsule of the tumor, and it is not pedunculated. Whether the tumor is intraligamentary or an adherent tumor can be determined by incising the capsule for about half an inch in length and through the first layer or capsule. If it is intraligamentary the edges of the incision will retract. When the ovary and tube on the other side are normal, and the tumor is in the upper part of the ligament and does not dip down deep in the pelvis, it should be removed by enucleation from above downward. The ovarian vessels should be ligated at the side of the pelvis, the upper part of the ligament opened up and the tumor shelled

out with the fingers or dry dissector, the bleeding vessels, if there are any, controlled, and the top of the ligament closed with a continuous suture. The enucleation should be done before tapping when the cyst is small, but if too large to be managed in that way the presenting part of the tumor should be separated from its capsule and a portion, but not all, of the contents removed. The trocar should be withdrawn and the opening closed with forceps. Then the slack of the sac should be drawn out and securely fixed with long-bladed forceps so as to put the remaining portion of the sac on tension, which facilitates the separation of the cyst wall and ligamentous capsule.

The second class of intraligamentous tumors that dip deep down into the pelvis should be removed along with the uterus in the way that Kelly does an abdominal hysteromyomectomy.

The most competent method of dealing with this class of ovarian tumors is that of Carey Kennedy Fleming, of Denver, Colorado, which was evidently suggested to him by Pryor's operation for the extirpation of intraligamentous fibromyomata of the uterus, published in the "Medical News," December, 1894. The first account of Fleming's operation was given in the "Denver Medical Times," November 1, 1897. Soon thereafter Rufus B. Hall, of Cincinnati, described in the "New York Medical Journal" a similar method of operating in such cases. From this it appears that Fleming and Hall were simultaneously interested in the evolution of this most valuable method of operating.

Fleming, who appears to have been the first (by a few days) in the field, gives the following directions for operating: Immediately after opening the abdomen the ovarian artery on the tumor side should be ligated in the infundibulopelvic ligament. If the cyst is a large one a part of its contents should be withdrawn and the puncture closed with a pair of heavy pedicle forceps. The broad ligament on the free side is cut between the ligatures down to a point near the internal os. The anterior flap containing the bladder should now be made and should consist of enough peritoneum from the anterior surface of the uterus to cover the stump of the cervix. A posterior flap of peritoneum, such as is recommended, we never make even in ordinary abdominal hysterectomies, as it simply consumes time and offers no apparent or real advantages over the single anterior flap. After completing this step the uterine artery is found and ligated in the usual way. The uterus should be amputated above the supravaginal junction and the uterine artery on the tumor side either ligated or clamped.

Then, after elevating the amputated body of the uterus, the first and second fingers are insinuated between the folds of the broad ligament and the cyst rapidly enucleated from below upward, and the whole mass finally comes away.

It is astonishing with what ease this can be done. As Pryor says regarding the myofibromata, so I can say regarding the cyst: "It will come out of its bed as easily as a mandarin orange can be divested of its rind." There is absolutely no bleeding, as the arteries are all under control. The final step consists in trimming the broad ligament, leaving only enough of the peritoneum to make a good flap to

cover over the denuded area. The flap is finally held in place by a continuous catgut suture, which is also used to close in the anterior flap over the cervix. When finished the field of operation resembles very closely the appearance of the ordinary abdominal hysterectomy save that the line of catgut sutures on the cyst side is a trifle longer than the other. By this method the operation has been raised from being one of the most difficult and dangerous to a comparatively easy and safe procedure.

One will not fail in operating by the method described, excepting in cases complicated by cellulitis which so firmly unites the cyst wall to the ligament and pelvic cellular tissue that they cannot be separated. I have met two cases of this kind in which I failed to remove the whole cyst wall. In both I removed all that I could of the tumor, destroyed the lining membrane by cauterization, opened the vagina and the cyst wall, stitched them together, put in a drain, and then closed the broad ligament from above.

Cleansing the Peritoneal Cavity.—The competent operator seldom finds any necessity for touching the peritoneum after the tumor has been removed. It is only when blood or the contents of the cyst have through accident or carelessness escaped into the peritoneum, or in some other way contamination of the parts has taken place, that cleansing is required, and it is always a misfortune to be obliged to resort to such a procedure. When the pelvic peritoneum alone is involved I prefer to sponge it clean and dry. If the sponging is done gently and carefully the parts can be made as clean as by irrigation. The fact is that in case the blood or fluid is limited to a part of the cavity irrigation distributes it throughout the abdominal cavity, so that no washing that can be tolerated will remove it all. Irrigation is usually practised by pouring in sterilized water or saline solution and allowing the excess of what the cavity will hold to flow out. This is continued until the water returns clear. The water remaining in the deeper parts of the cavity is allowed to remain by some and by others it is removed by sponging. The use of sponges for this purpose is most objectionable, owing to the damage they do to the peritoneum and abdominal wound.

In order to avoid irritating or injuring the tissues I employ the same aspirating instrument used for evacuating cysts, using instead of the trocar and cannula a glass tube of large caliber and a number of perforations at the distal end. Ascitic fluid and liquid blood are removed in the same way. This can be done more quickly and with less injury to the tissues, and without wetting the patient's clothing.

Drainage.—Drainage should be employed (1) when from the adhesions that had to be separated there is sure to be a free transudation of bloody serum; (2) when all bleeding has not been stopped, and (3) when either of the conditions named are present and the patient is feeble and anemic. The necessity for drainage is always unfortunate because it delays the recovery and favors the subsequent occurrence of ventral hernia. The object should be to operate so that drainage should not be necessary. One finds that as he improves in operating fewer cases need drainage. Since giving up the use of ligatures and stopping with electric heat the

oozing from raw surfaces left after separation of adhesions, I have had no need for drainage in any of my cases.

Closing the Abdominal Wound.—The omentum should be drawn down and spread over the intestines to keep them away from the abdominal wall. A flat sponge or gauze pad is placed over the omentum and beneath the edges of the wound and left there while the sutures are being introduced. Two curved sharp-pointed needles are used for each suture, one at each end. The needles are introduced from the inside of the abdominal wall and include the peritoneum, but not enough of it to project upward into the wound. The presence of a sponge or gauze pad in the abdomen while introducing the sutures protects the omentum and intestines from injury and takes up the blood that comes from the needle wounds. Having introduced all the sutures, the ends on each side are gathered together and held while the flat sponge is removed. The air should be pressed out of the abdominal cavity and the sutures tied.

The great object in the method of closing the wound is to bring all the tissues together in their original relations so that they may promptly unite and leave the abdominal wall as strong as ever, to the end that ventral hernia may be prevented.

The removal of the sutures requires special attention. The knot (which should be on one side of the wound) is seized and drawn upon until a fresh portion of the suture emerges from the skin surface, when this is divided with sterile scissors. By removing sutures in this way one avoids carrying septic matter from the surface into the track of the suture.

AFTER-TREATMENT.

Attention should first be given to the prevention of shock, or to relieve it if present in any degree. The head, face, and neck, usually bathed in perspiration, should be wiped with a warm, dry towel, and the head covered with a soft woolen shawl or blanket. The body should not be exposed or moved more than is absolutely necessary.

The bed in which the patient is placed should be warmed to about the normal surface temperature. The hands should be kept under the bed-covers and not disturbed to examine the pulse, which can be watched at the temporal artery. A hot-water bag may be placed near the feet, but not in contact with them. I have repeatedly seen the feet burned by placing a hot-water bag close to the skin. This will not occur when the bag is wrapped in flannel and kept at a little distance from the body. The air in the room should be kept at about 70° F., and ventilation secured without having the patient in a draft. For a number of hours ether is thrown off with the expired air, and it is difficult to keep the air in the room agreeable. It is fortunate if the patient sleeps after the operation, and no effort should be made to awaken her to find out how she is doing, as is frequently done.

During the first twenty-four hours or more, the greater the amount of rest that can be obtained the better. Absolutely nothing should be given in the way of food or medicine unless there is some urgent demand for either. Nausea and vomiting,

which occasionally occur, should be counteracted with sips of hot water if the patient is anxious to have something to drink, but not otherwise.

Keith usually gave a hypodermic dose of morphin immediately after the operation to control the restlessness which supervenes when the patients come out of the anesthetic. This is not always necessary. I wait and see if there is much restlessness or pain, and if there is, the hypodermic is given. Nervous restlessness alone can often be controlled by the efforts of a judicious, experienced nurse. If the patient can be controlled until night, it is better to withhold the morphin until then.

This expectant treatment should be continued until the stomach has become reliable and gas has passed from the bowels. In many cases nothing is required during the first forty-eight hours. I am sure that great harm is done by giving nourishment and medicine when there is no demand for either. I certainly have seen more harm come from doing too much at first than from doing too little. There are exceptions to this rule of doing nothing. In case the vomiting continues and is not relieved by hot water I use the following: *Magnesiæ carb.* ℥j; *magnesiæ sulph.* ℥ij; *aquæ menth. pip.* ℥iij. Of this, a teaspoonful may be given every one, two, or three hours in a dessertspoonful of water. This prescription is used in the Samaritan Hospital in London. A mustard plaster over the pit of the stomach is also useful.

When these remedies fail and the patient complains of burning in the stomach, dessertspoonful doses of ice-water may be used. When the patient is depressed, ten drops of whisky in a teaspoonful of water, every few minutes, will be of service. In desperate cases I have given a large quantity, as much as the patient could drink, of lukewarm water and a little table salt. This is thrown off promptly and sometimes gives relief. It should not be repeated. If relief is not obtained and the nausea returns, the stomach should be washed out in the usual way.

When the vomiting is attended with abdominal pain, morphin hypodermically will give relief in many cases.

Peritonitis and Septicemia.—From recent reports in the literature of medicine it appears that a new departure has been taken in the after-treatment of cases of ovariectomy and similar operations. In place of giving opium and keeping the bowels at rest for several days, the bowels are moved early, and opium is withheld. Cases which show signs of septicemia or peritonitis are given saline cathartics. It is claimed that free action of the bowels effects a kind of drainage which arrests the tendency to inflammation of the peritoneum, and also favors the elimination of septic material. One should gladly accept whatever theories or facts may be advanced in favor of this treatment, or any other which might prove better than the old ways of managing such cases. But I have failed to see that this new treatment has many advantages.

So far as I can learn, the results, on the whole, do not compare well with those of other surgeons who give opium and let the bowels and the stomach rest until the first dangers are past. Furthermore, I have found in my own practice that as

soon as the indications for cathartics appear, it is impossible to have the patient retain them, in the great majority of cases.

Perhaps the advocates of this treatment may be able to anticipate the coming storm, and, by giving saline cathartics, ward it off; but I have not been able to do so.

While there are a number of reasons why opium should be used, I have not yet heard of any good reason why it should not be, in certain cases. That there are patients who do not need opium, and others with whom it does not agree, must be admitted; but the majority require it to relieve pain, produce sleep, and, above all, rest and quiet, which are so very necessary to recovery after major operations. These effects of opium, it may be claimed, simply contribute to the comfort of the patient but do not secure safety or aid in recovery. Granting that such may be the case, the humane surgeon will find in this good reason for the use of opium, but I am confident that opium has a therapeutic value in addition to that of relieving suffering.

The danger from shock that arises from major operations is, I am sure, controlled by opium better than by any other drug. So also is the depression from anemia resulting from hemorrhage. All careful observers have noticed that the rapid feeble pulse becomes fuller, slower, and steadier under the influence of opium. The anxious, pinched face also changes to a better expression. This has led me to look upon opium as the most reliable of all nerve and heart tonics in the depression which follows these operations. When the organic nervous system is tottering under the oppression of severe injuries to the abdominal and pelvic viscera, opium is the greatest sustaining agent. Alcohol, no doubt, will bridge over a moment of extreme and immediate danger, but its effect must always be supplemented with opium in order to obtain a continuous sustaining effect.

Perhaps more important still is the question, Does opium have the power of preventing peritonitis and septicemia, or of controlling their fatal tendencies? To judge fairly of the therapeutic effects of opium in surgery, it is necessary to keep in mind the fact that after an operation there are injured tissues left that must be repaired. These tissues may or may not be affected with septic material, but in either case the safety of the patient depends upon these wounded tissues being speedily closed in by reparative material, which restores continuity of tissue and at the same time protects the normal surrounding tissue from inflammation and the patient from general septicemia. Now this process by which the general system is protected from the dangerous effects of local injuries requires time; and it is the most important time, because upon completion of this protection depends the safety of the patient, to a great extent. Wounds may do badly, but, if an exudation has been thrown around them which protects from septicemia, recovery may be expected. Of course, the modern surgeon protects his cases from sepsis by his cleanly operating; but in spite of his best efforts there may be trouble occasionally, and then the great point is to gain time for this natural protective process, which comes, or should come, first in the order of restoration. The principal condition necessary to secure the protective factor in the general process of repair is repose or quietude of the nervous and circulatory systems, and opium is the most potential agent in

affecting this condition. The process of repair is arrested when the nervous system is in turmoil and the circulation is running wild, and opium should be used to give the necessary rest. It is a fatal mistake to wait until there is evidence of inflammation or septicemia. It should be given to control the nervous excitation which generally precedes these complications.

The time to give it, then, is an important question. Some of the most successful surgeons give it immediately after the operation, if the case is bad and there is shock. In easy cases I prefer to wait until the ether effects pass off to some extent, and if there is distress or pain present, then is the time to give opium, and the effect should be kept up until there is no danger of complications, so far as the condition of the patient indicates.

The way of giving it is of some importance, no doubt. I prefer to give it at first hypodermically, and keep up the effect in that way, or by rectal instillations of opium and warm water.

The question which follows is this: When shall the opium be withdrawn and cathartics resorted to? Opium should be gradually withdrawn as the constitutional and local evidences of disease subside, and then cathartics or laxatives should be given. To state this in another way: Opium should only be given when there are indications for its use, and it should be discontinued as soon as the indications disappear. The bowels should rest until the time for peritonitis is passed, or, if there has been inflammation or sepsis, when the acute symptoms and signs of these have subsided.

CHAPTER XV.

VAGINAL SECTION FOR DISEASED OVARIES AND TUBES.

By HENRY T. BYFORD, M.D.

History of Vaginal Ovariectomy and Oöphorectomy.—The first ovarian cystoma removed through the vagina was in the practice of W. L. Atlee, in 1857, in which the free abdominal cavity apparently was not entered.¹

T. Gaillard Thomas deserves the credit of having, in 1870, planned and executed the first vaginal section for the removal of an ovarian tumor.² A similar operation was performed, in 1872, by D. R. Davis; in 1873 by T. J. Gilmore, and also by Robert Battey; in 1876 by Clifton Wing; in 1880 by W. H. Baker, and about that time by a few others.

Robert Battey³ performed the first vaginal oöphorectomy in 1873, and others in 1874, 1875, 1876, 1877. J. Marion Sims⁴ performed it twice in 1875 and twice in 1877.

According to Goodell's statistics,⁵ up to July, 1876, abdominal oöphorectomy had been performed 16 times with 6 deaths, and vaginal oöphorectomy 24 times with 2 deaths. The difficulties encountered caused the method to fall into disuse until adopted by the author,⁶ in 1887, and by Péan and his followers in 1889.

Dührssen's paper on vaginal laparotomy⁷ had a decided effect in popularizing anterior vaginal ovariectomy and oöphorectomy in Germany. W. R. Pryor has more recently demonstrated how, with improved instruments, the posterior pelvic space can be treated with surprising facility.⁸

Conditions for Which the Operation May Be Done.—*Vaginal section for tumors of the ovaries and Fallopian tubes:*

(a) Enucleation of small intraligamentous parovarian cysts and cysts of the broad ligament.

¹ Goodell, Wm.: "A Case of Vaginal Ovariectomy," *Trans. Amer. Gynecol. Soc.*, 1877, vol. ii, p. 257; Atlee, W. L.: "Sarcoma of the Ovaries," *ibid.*, 1877, vol. ii, p. 326.

² Baker, W. H.: "Vaginal Ovariectomy," *N. Y. Med. Jour.*, March, 1882, vol. xxv, p. 250.

³ Battey, Robert: "Extirpation of the Functionally Active Ovaries for the Remedy of otherwise Incurable Diseases," *Trans. Amer. Gyn. Soc.*, vol. i, 1876, p. 101.

⁴ Sims, J. Marion: "Remarks on Battey's Operation," *British Med. Jour.*, Dec. 8, 1877, p. 793.

⁵ Goodell, Wm.: "A Case of Spaying for Fibroid Tumor of the Womb," *Amer. Jour. Med. Sci.*, July, 1878, vol. lxxvi, p. 36.

⁶ Byford, Henry T.: "Removal of Uterine Appendages and Small Ovarian Tumors by Vaginal Section," *Am. Journal Obstet.*, vol. xxi, April, 1888, p. 337.

⁷ Dührssen: "Uebereine Methode der Vaginalen Laparotomie," *Berlin. klin. Wochenschrift*, 1894, Nr. 12, S. 296.

⁸ Pryor, W. R.: "The Treatment of Adherent Retroposed Uteri," *Trans. Amer. Gynecol. Soc.*, 1898, vol. xxiii, p. 50.

(b) Removal of non-adherent ovarian cystomas the size of an adult head and smaller.

(c) Removal of pediculated parovarian cysts.

(d) Removal of adherent ovarian cystomas the size of a cocoanut and smaller, when extending into the cul-de-sac of Douglas.

(e) Removal of solid benign neoplasms of the ovaries and tubes the size of the first and smaller, when either non-adherent or adherent in the cul-de-sac of Douglas.

Vaginal section for diseased conditions of the ovaries and tubes, other than tumors:

1. Exploratory incision.
2. Removal of non-adherent ovaries and tubes.
3. Separation of adhesions.
4. Resection of the ovaries and tubes.
5. Removal of adherent ovaries and tubes.
6. Evacuation of pus accumulations.

By vaginal section we can also remove small uterine fibroids, and small neoplasms of the omentum and round and broad ligaments. We can suture the retroflexed uterus over the bladder; shorten the round, sacrouterine, and ovarian ligaments; and bisect the anterior or posterior uterine wall for the treatment of the endometrium under the direction of the eye, and for the reduction of inversion of the uterus.

Pathology, Etiology, and Diagnosis of Neoplasms.—(a) Small intraligamentous parovarian cysts are unilocular and, on account of the loose arrangement of the connective tissue of their walls, the epithelial lining can be easily enucleated. As a rule, they are not discovered until they have grown too large to be reached through the vagina.

(b, c) Non-adherent ovarian cystomas and pediculated parovarian cysts of moderate size can be pressed or pulled down to the vaginal incision and evacuated by a trocar, and the collapsed walls be easily removed. Their differentiation from a small non-adherent sactosalpinx serosa may in some cases be difficult or even impossible. But this is of little consequence unless we attach importance to the fact that a hydrosalpinx will seldom grow, and its removal in many cases may be indefinitely postponed. If the hydrosalpinx can be felt to be sausage-shaped, sensitive, and freely movable upon the flabby isthmus, and the ovary be discovered, there will, of course, be no such difficulty.

(d) The differentiation of small adherent cystomas from salpingitis with adhesions is made out mainly from the progressive severity of the symptoms, their presence in young women (dermoids), the gradual increase in size, the discovery of elastic areas, and in dermoids perhaps of hard ridges corresponding to bony or cutaneous masses.

(e) Solid benign neoplasms when large are seldom adapted to treatment by a vaginal operation, because the pedicles are usually short, thick, and vascular, and it is difficult to reduce the mass in size through a small opening, as in the case of cystic tumors. When located in the cul-de-sac of Douglas they are apt to contract

adhesions, but they then cause symptoms and are liable to be discovered before becoming too large for removal through the vagina.

Pathology, Etiology, and Diagnosis of Inflamed Ovaries and Tubes.—

(1, 2) Inflamed and enlarged ovaries and tubes are often situated low in the pelvis and they can be examined as well through a vaginal as through an abdominal incision, and with greater safety to the patient. At the same time, it is generally possible by enlarging the incision to perform the necessary operation through it.

By means of a previous bimanual examination the degree of mobility of the uterus and adnexa can be determined, and the indications for and the contraindications to vaginal section be discovered. If the fingers of one hand are pressed deeply into the abdomen over the sacroiliac synchondrosis, one or two fingers of the other hand can be pressed up well back beside and behind the cervix to meet them from below. The approximated fingers of both hands can now be drawn toward Poupart's ligament until the ovary is felt to slip between them, and its mobility and the laxity of its lateral pelvic attachments (and thus, in case of an operation, the ease or difficulty of its delivery into the vagina) be ascertained. The Fallopian tube can also be made to slip between the fingers of the two hands, and its condition be tested. It feels, when normal, like a soft, flabby, freely movable cord or fold of tissue, and it is more easily felt when diseased or sacculated from closure of the fimbriated end.

(3) Adhesions of the adnexa are in a large proportion of cases on the lower parts of the broad ligaments, on the sacrouterine ligaments, or in the cul-de-sac of Douglas, and not connected with exudate high up and at the sides of the pelvis.

In such cases the uterus is more or less movable, and the shape and location of the diseased parts can usually be defined digitally and bimanually.

(4, 5) Diseased ovaries and tubes, brought into the vagina through the incision after separation of the adhesions, can be either resected or removed. The tunica albuginea may be thickened and the ovisacs dropsical or apoplectic. Organized blood-clots may persist in the corpora lutea, and the stroma be thickened by interstitial proliferation, and invaded by minute or even large-sized blood-clots. The fimbriated ends of the tubes may be closed.

The extent of these conditions and the possibilities for their relief cannot be determined definitely until after the vaginal incision is made. Local symptoms, not accounted for by pus, may indicate the nature of the lesions, since extensive interstitial changes and the presence of blood-clots in the ovary give rise to more persistent pain and more profound nervous disturbance than adhesions without them.

(6) Acute or subacute pelvic peritonitis, with exudate and high temperature, may often be successfully treated by making an exploratory incision through the posterior vaginal fornix, introducing one or two fingers into the peritoneal cavity, and forcing them into any pus accumulation that can be palpated. A large rubber tube and gauze packing that reaches to the pus area should be introduced. The diseased organs can be removed later when the acute symptoms have subsided, although the patient may then feel so well as not to submit to an operation.

Choice of Methods of Operating.—Three principal methods of performing vaginal section for the removal of diseased appendages without removing the uterus are available, viz.: anterior, posterior, and lateral colpotomy.

Posterior colpotomy (colpo-celiotomy posterior) is the simplest method, and is preferable for operating upon non-adherent neoplasms or adnexa, and upon those adherent in the cul-de-sac of Douglas or over it, provided the cervix is freely movable, or is pressed forward toward the pubes. Tuberculous appendages with peritoneal infection and ascites limited to the pelvic cavity have also been successfully treated by this method.

Special *contraindications* to this method are a fixation of the cervix near the sacrum, adhesions of the offending parts high up in the pelvis or in its anterior portion, and contraction or induration of the sacrouterine ligaments.

Anterior colpotomy (colpo-celiotomy anterior) is to be preferred when the appendages are adherent near the uterine horn, when there is retroversion that will require a suturing of the fundus forward or a shortening of the round ligaments, and when there are also tumors on the anterior uterine wall to be removed.

The special *contraindications* are fixation of the cervix, firm adhesions of the fundus uteri, of the tumor, or of the uterine adnexa in the cul-de-sac of Douglas or high up at the sides of the pelvis, pus sacs with extensive adhesions, and tuberculous adnexa involving the peritoneum.

Lateral colpotomy (colpo-celiotomy lateralis) is occasionally performed as an extension of the above-mentioned operations, and is indicated when the anterior or posterior incision does not afford sufficient room for completion of the work. Extensive lateral adhesions, development in the broad ligament, bowel injury requiring repair, large tumors that have to be reduced, and inaccessibility of the parts, may exceptionally make it necessary to reach further, or obtain a better view.

The anterior or posterior incision may then extend laterally on either or both sides of the cervix; or the incision may extend from the anterior incision laterally on one side and round behind the cervix across the posterior fornix; or it may begin behind and extend around one side and across the anterior fornix. The author, in one case, made a circular incision completely surrounding the cervix, opened the peritoneal cavity both before and behind, and, after ligating both uterine arteries, separated the bases of both broad ligaments from the uterus. The tissues were sutured back in their proper places and united promptly. By means of such incisions almost as much room can be gained as if the uterus itself were removed.

The *contraindications* are extensive induration of the broad ligaments, and any condition which would interfere with primary union of the tissues to the cervix, or with the manipulations necessary for the suturing of the parts in place.

Preparation of the Patient.—The preparation of the patient includes all that belongs to the preparation for celiotomy, for it occasionally becomes necessary to finish with an abdominal incision.

If the patient is under observation for several days before the operation she

should take a copious hot douche twice daily, followed, if practicable, by a warm sitz-bath. The vulva should be shaved and washed with soapsuds before the final general bath is taken. A few hours before the operation four consecutive vaginal douches should be given, viz.: one of soapsuds, followed by one of sterilized water, then by one of corrosive mercuric chlorid (1 : 2000), and finally by another of sterilized water.

The last laxative enema should be given as early as twelve or eighteen hours before the operation, otherwise the bowels are liable to move during the operation and render it difficult to keep the field aseptic. A plain water low enema should be given two or three hours before, in order to wash out the rectum.

Instruments, etc.—The table should be so placed that when the patient is put in the dorsal posture the light will shine directly in the vagina. If at all possible, arti-



FIG. 302.—INSTRUMENTS USED IN VAGINAL OVARIOTOMY AND OÖPHORECTOMY (TROCAR OMITTED).

ficial light should be available that can be thrown over the operator's shoulder or from his forehead.

In addition to the ordinary instruments used for celiotomy the following should be provided: Several retractors of different lengths and widths, such as Pryor's anterior and posterior, Jackson's or Simon's posterior, and two narrow lateral ones; several long-handled forceps; vulsella to hold the cervix; long-handled needle-holder; long-bodied tenacula; uterine sound; urethral sound; long-handled scissors (sharp-pointed and blunt-pointed); small trocar, five or six inches long; ovary forceps; pedicle clamp or forceps to hold the ovarian pedicle without bruising it while the ovaries are examined and resected; instruments for dilating and curetting the uterus; straight needles, half inch and one inch long with slight curve on the end; pedicle needles with curved end, etc. Sterilized two- and four-inch gauze should be at hand in large quantities.

TECHNIC OF THE OPERATION.

Preliminaries.—The patient is put in the dorsal position (the vulva having been previously shaved), and the vulva, perineum, and vagina are thoroughly

scrubbed with soft soap, then with alcohol, and finally with a solution of mercuric chlorid (1:2000). The external parts are scrubbed with gauze, and the vagina with a slender, soft brush or gauze swab.

As the first step the uterus should be cureted, disinfected, and packed with sterilized gauze. A stout silk thread should then be passed through both walls of the cervix in the median line at the vaginal junction, tied so as to close the cervix, and be left long enough to be used as a tractor.

Technic of Posterior Colpotomy.—One assistant draws the cervix toward the pubes with the silk tractor, and another holds the perineum back with a retractor.

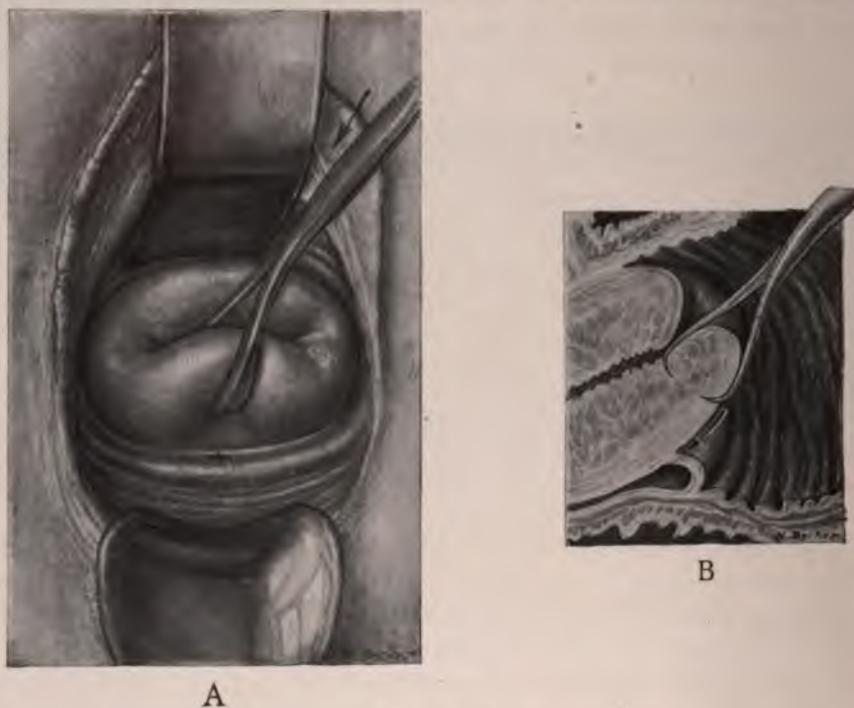


FIG. 303.

A, Cervix drawn upward and forward showing the place of incision in posterior colpotomy—indicated by the cross. B, Same as A shown in sagittal section of uterus and vagina. The arrow indicates the place of incision and shows where the peritoneal cavity is entered.

The operator hooks or catches up the posterior vaginal wall near the cervix and, with long-handled, sharp-pointed scissors, incises the vaginal wall in the median line from the cervix downward for an inch or an inch and a half. This median incision is the preferable one in case the adnexa or tumor be movable, because it does not bleed much and can be easily closed by sutures. Then the exposed connective tissue near the cervix is hooked up and snipped, and if after penetration for half an inch or so the peritoneal cavity is not opened the finger should push up forcibly behind and against the cervix until it breaks through the peritoneum.

Then the peritoneal edges should be grasped by lock forceps, drawn into view

and the peritoneum incised downward to the bottom of the cul-de-sac, and the opening be enlarged if necessary by digital stretching. If any pus is to be dealt with, the intestines can now be pushed up out of the pelvis by one or two medium-sized gauze sponges attached to long tapes. Adhesions are then separated.

In case a cystoma is to be removed it is hooked down as near to the vaginal incision as possible while suprapubic pressure is made by an assistant. A short, broad retractor is then introduced, and the fluid is drawn off with a trocar. The sac is caught by forceps and pulled into the vagina as it collapses. If any fluid has entered the peritoneal cavity the cul-de-sac is douched out thoroughly with sterile water or normal salt solution. The pedicle is then drawn into the vagina and ligated.

Lateral vaginal retractors are usually requisite to hold the incised vaginal edges away from the trocar, and afterward the vaginal wall from the pedicle. When the parts can be brought forward near the vaginal entrance the retractors should be so short that they will not push them back, but when the parts cannot be brought forward the retractors should be long enough to reach to and even through the vaginal incision, and secure as much intravaginal working space as possible.

When diseased adnexa are to be removed the incision is made as for a tumor. The retractors are then removed and the index and middle finger of the left hand are introduced to break up adhesions on the patient's left side, and the fingers of the right hand to do the same on the opposite side. It is often better to break up the adhesions on both sides pretty extensively before removing or resecting the adnexa, for that makes it possible to draw the parts nearer to the vulva.

The adnexa of the left side are then hooked down into the vagina with two fingers and either the ovary is grasped by ovary forceps or the ovarian ligament by long hemostatic forceps. Retractors are introduced, the pedicle ligated, and the parts cut off. The stump is disinfected and allowed to retract into the abdomen, and the right side is attended to. If the ovary or tube is to be resected a pedicle clamp or forceps is put on the pedicle to hold the ovary or tube as near the external parts as possible. After the work is done the traction upon the forceps is relaxed, and any oozing that follows is checked by catgut sutures. The cul-de-sac of Douglas is sponged or douched out and a sponge placed in it.



FIG. 304.—ADNEXA DELIVERED INTO THE VAGINA THROUGH THE OPENING MADE THROUGH THE POSTERIOR VAGINAL FORNIX.

In closing the incision the peritoneal edges are held in view by a pair of lock forceps, one on each side, and catgut sutures are passed from side to side, including vaginal walls and peritoneum. The upper suture may be tied as soon as placed, to be used to draw forward the tissues. After all sutures are in, the gauze is removed from the cul-de-sac and they are rapidly tied. The vagina is then packed loosely with sterile gauze, the uterine gauze being taken out or left in for twenty-four hours, as the operator may prefer.

If drainage be required the incision is left partly or entirely open, and a gauze packing used, which leads from the oozing surfaces out into the vagina.



FIG. 305.—RESECTED OVARY BEFORE BEING RETURNED THROUGH THE INCISION IN POSTERIOR FORNIX.

If the tumor be of a large size or the adnexal adhesions extensive, a transverse vaginal incision will give somewhat better access, but it is more bloody and is not so easily reunited. A transverse vaginal incision from an inch to an inch and a half is made near, but not against, the cervix, and the peritoneal cavity entered in the same way as through the median vertical incision described above. The opening is enlarged to the required extent by tearing with the fingers. If there is much bleeding the peritoneal edges should be united to the vaginal edges. Through this incision Pryor's long, broad, anterior retractor can be introduced, and the posterior pelvic peritoneal space be rendered visible. In cases in which this incision is necessary it is more often left open for drainage, although it can be sutured.

Technic of Anterior Colpotomy.—

After curetage of the uterus the cervix is pulled down to or near to the vaginal entrance by means of vulsella. A short transverse incision is made in the anterior vaginal wall at the junction with the cervix, and the finger is pushed upward firmly against the cervix until it separates the bladder and breaks into the peritoneal cavity. After penetrating the peritoneal cavity a median longitudinal vaginal incision is made from the center of the transverse incision for about two inches, or five centimeters, toward the urethra. The bladder is now freely separated from the uterus and vaginal incision, and is pushed up while the peritoneal opening is enlarged transversely by stretching.

The cervix is held down as near the vulva as practicable, and two fingers are

passed into the peritoneal cavity to explore the pelvis, separate adhesions, and pull the tumor or appendages into the vaginal incision. The ovarian ligament can usually be grasped between the two fingers, and if the cervix is pushed back toward the hollow of the sacrum, the fingers can draw forward the uterine horn and the neoplasm or diseased adnexa to the vaginal opening.

If there be a cystoma the ovarian ligament is grasped by lock forceps and held at the vaginal incision while retractors are introduced and the fluid drawn off by puncture or trocar. Pressure over the tubes by the hand of an assistant may be employed and is sometimes necessary. The empty sac is pulled into the vagina and the parts are douched with sterilized water. All retractors but the anterior are removed, the pedicle is grasped by the finger and thumb of the left hand, transfixed and tied by a strong catgut ligature, and the tumor is cut off. The parts are then disinfected or cleansed and allowed to retract.

In removing the diseased adnexa, it has usually been customary, following Dührssen, to release the cervix, grasp the anterior wall of the uterus with vulsella, and draw the fundus into the vagina as soon as possible after the peritoneum is entered; and then separate the adhesions and remove the parts while the fundus is still in the vagina. As it is possible to hook the finger over the broad ligament near its uterine end and grasp it with forceps, the uterine horn can be pulled forward without wounding the uterus with vulsella. I have usually found it unnecessary and objectionable to deliver the fundus into the vagina, as its bulk is apt to tear the vaginal edges wider open and to interfere with manipulations. Adhesions that are not relieved by the earlier maneuvers can often be treated by sight after the cervix is pushed back and the corresponding uterine horn pulled to, but not through, the vaginal incision. After the ovaries and tubes are resected or removed and the remaining parts restored to the peritoneal cavity, the vagina is held open by retractors, and the peritoneal edges drawn down by lock forceps and sutured by a continuous catgut suture. In closing the vaginal edges the connective tissue of the bladder wall and that laterally situated are caught up, and thus the bladder is reattached to the cervix and vaginal wall,



FIG. 306.—INCISION AT JUNCTION OF ANTERIOR VAGINAL WALL WITH CERVIX IN ANTERIOR COLPOTOMY.

and the oozing connective-tissue space as nearly as possible obliterated. As a complete obliteration is not always possible, it is well to leave a little space between the stitches just in front of the cervix, and to introduce a few folds of one or two-inch sterile or nosophen gauze, to be pulled out at the end of twenty-four hours. This will prevent an accumulation of blood and possible abscess formation. I usually also leave the uterine gauze and a loose vaginal packing in place for twenty-four hours, and follow their removal by mildly antiseptic douches every eight or twelve hours. If there be any persistent oozing from the tissues above the peritoneal



FIG. 307.—SEPARATION OF THE BLADDER FROM THE CERVIX IN ANTERIOR COLPOTOMY.

edges, the peritoneal incision may be left open for drainage. But in such a case considerable gauze must always be packed between the bladder and uterus, and sufficient space for free drainage be left between the vaginal sutures where the gauze emerges. The gauze should be removed in about thirty hours, a normal salt solution douche be given after another thirty hours, and be repeated every eight or twelve hours. When drainage of the spaces behind the uterus or broad ligaments is desirable, a free incision posteriorly into the cul-de-sac of Douglas may be made, and a gauze drain inserted.

Technic of Lateral Colpotomy.—In performing lateral colpotomy the cervix should be drawn toward the vulva and to one side, in order to expose and render accessible the lateral vaginal fornix. If the object of the operation be merely a ligation of the uterine artery and the enucleation of an abscess, the incision may begin at the side of the cervix and extend straight out laterally; or it may extend toward the sacroiliac synchondrosis if the tissues to be reached are situated in that direction.

In performing a complete lateral colpotomy or colpoceliotomy, it is preferable to



FIG. 308. —LIGATION OF PEDICLE OF OVARIAN CYSTOMA THROUGH INCISION IN ANTERIOR VAGINAL FORNIX.

make the incision longitudinal beside the cervix in order that it may at any time be extended around the cervix in front or behind, and the advantage of a combination with anterior or posterior colpotomy be secured.

The first incision may be made with sharp-pointed scissors or with a knife, and should go through the vaginal wall only. The farther penetration should be made by the finger or knife-handle unless it is directly toward an abscess or tumor situated low down laterally or posteriorly. If it is necessary to penetrate upward, the finger

pushes up beside and against the cervix, in order to keep inside of the course of the ureter, until the uterine artery can be seen or felt to pulsate. The artery is then laid bare for a short distance from the cervix, tied with catgut in two places, and severed between them.

The connective tissue behind the uterine arteries is now caught up with forceps and snipped with scissors until the peritoneal membrane is seen and penetrated, or the finger can force its way into the cavity by pressing firmly backward near the cervix. After a digital exploration has been made, the peritoneal opening can be enlarged by tearing, or it can be incised in the direction of the parts to be operated upon. If the vaginal incision is not large enough, it should be prolonged around the cervix either anteriorly or posteriorly as indicated by the position of the parts to be reached. If forward, the bladder and ureter are pushed forward. Vaginal arteries, or arteries in the connective tissue which are cut or exposed, should be immediately ligated with fine catgut.

Long retractors may be used to reach into the peritoneal cavity and expose the adnexa or tumor *in situ*. On the right side the appendix vermiformis can sometimes be seen and treated (Pryor). Through a left incision the sigmoid flexure can be seen, particularly if rendered prominent by induration, neoplasm, or by artificial distention.

At the end of the operation the incision can be partly closed, the peritoneum being shut off or not, according to the indication, for drainage, and gauze be packed into the incision and vagina; or, if the opening has been small, it may sometimes be entirely closed by the sutures.

In anterior and posterior colpotomy the incision may be extended around the cervix on either side, provided the uterine artery be doubly ligated and the bladder and ureter pushed up.

Separation of Adhesions.—As in abdominal section for similar conditions, ordinary adhesions other than intestinal may be safely separated by the sense of touch.

In posterior colpotomy two fingers introduced into the peritoneal cavity will suffice. Intestinal adhesions can usually be drawn to the vaginal incision and separated by the aid of sight. Intestinal raw surfaces can be sewed or puckered by fine catgut sutures. Intestinal tears can be repaired through an enlarged incision that passes far out laterally or around the cervix on one or both sides (lateral colpotomy), and which if necessary includes ligation of the uterine arteries and severance of the bases of the broad and sacrouterine ligaments.

In anterior colpotomy the fundus can be drawn into the vagina and the manipulations be conducted under the guidance of the eye (Dührssen). More room may here also be gained for the treatment of hemorrhage or for intestinal suture by extending the incision backward, beside, or around the cervix on the side nearest the parts to be reached and, if necessary, cutting the base of the broad ligament.

After suture of an intestinal tear, gauze packing should lead from the intestinal suture through the posterior vaginal fornix and the severed lateral and anterior vaginal and uterine tissues be sewed together in their proper relation.

Drainage.—Drainage of the peritoneal cavity is seldom necessary, hence the peritoneal cavity should, as a rule, be closed by suture. When intraperitoneal oozing cannot be checked completely, or when infected tissue is left, a gauze drain may be used to reach to the peritoneal edges or to the infected or bleeding area.

If the bloody oozing be moderate the gauze may be removed in twenty-four hours. If the oozing be abundant, or if there be an infected area, or an intestine has been sutured, the gauze may be left until the third day, when it should be removed and the vagina be douched with sterilized normal salt solution. A return tube should be placed in the vagina while the first two or three douches are being taken in order to avoid any pressure of the fluid toward the peritoneal cavity. If an accumulation of fluid should take place after the gauze is removed, the index-finger may be pushed into it through the contracted opening.

SUPPLEMENTARY OPERATIONS.

In a large proportion of cases adapted to vaginal section the uterus is retroverted or partly prolapsed, and may be in need of an operation for the relief of the displacement.

In case of a posterior colpotomy, the cul-de-sac of Douglas may be obliterated by suture or cicatricial contraction, and thus the cervix be held back. The sutures of a median incision may be made to include the peritoneum at the bottom, and sometimes of the posterior surface of the cul-de-sac (beside and around the rectum), and the vagina can then be tamponed so as to keep the posterior vaginal wall against the rectum. I have cured a few cases by the tampon alone. If the incision be transverse it may be sutured nearly or completely by transverse sutures that catch up as much peritoneum and connective tissue as possible, including the sacrouterine folds, and thus draw the cervix backward toward the sacrum.

Pryor leaves the cul-de-sac open and tampons it with gauze, which is removed in from seven to ten days and replaced. This is "repeated until the cul-de-sac closes." The cervix is held back by a roll of gauze in front of it for six weeks, after which it will stay (Pryor, *loc. cit.*). (See Fig. 370.)

By anterior colpotomy the bladder can be separated and pushed away from the uterus, and the uterus be sutured directly to the anterior vaginal wall (vaginal fixation). This is a good operation for retroversion in sterile women, but is liable to cause serious dystocia in the fertile (Dührssen and Mackenrodt). In child-bearing women the fundus can be sutured to the upper portion of the bladder,¹ or the round ligaments can be sutured into the vaginal incision,² or the round ligaments can be shortened by suture.³

On account of the desirability of relieving the retroversion and of finishing the

¹ Mackenrodt: Monatschr. für Geb. und Gyn., 1896, Bd. iv, S. 489.

² Wertheim: Centralbl. für Gyn., 1896, No. 10, S. 265; Vineberg: Am. Gynecol. and Obst. Jour., 1896, vol. viii, p. 771.

³ Bode: Centralbl. für Gynäk., 1896, Nr. 13, S. 357; Wertheim: *loc. cit.*; Byford: Am. Gynecol. and Obst. Journal, June, 1896, p. 774; and Goffe: Jour. and Trans. Amer. Med. Assoc., vol. xxxi, 1898, p. 508.

operation through the incision already made, I have adopted the vaginal method of shortening the round ligaments whenever an anterior colpotomy is performed in a case of retroversion or retroflexion.

I proceed as follows: After the ovaries are resected and removed I pull down the peritoneum from behind the pubes as far as possible with successive grasps of lock forceps, and pass two formaldehyd catgut threads of medium size through the serosa as high up as I can see it, and about half an inch on either side of the median line. The peritoneum is then released and the same threads passed through a few fibers of the fundus uteri half an inch on either side respectively of the middle line, and each tied tightly, thus bringing the fundus uteri against the peritoneum over the bladder. The uterus can, during this suturing, be held by forceps attached to the round ligaments near their uterine origin.

A round ligament is now drawn down into the vagina with persistent firm traction, and exposed as far toward the inguinal end as possible. A medium-sized formalin or chromic acid catgut suture is passed through it as far out toward its inguinal end as visible, and again through the uterine wall just over its uterine attachment and tied. Before the needle is unthreaded the suture is passed through the loop of the ligament that has been formed and the loop is attached to the uterus just internal to the previous attachment of the ligament. The same is done on the opposite side. The peritoneal edges and vaginal incision are then sutured as has already been directed for anterior colpotomy.

AFTER-TREATMENT.

The after-treatment in a general way is the same as after abdominal section. The suffering is usually less, and there is no necessity for the administration of opiates. If there should be much local pain, or any reason to fear hemorrhage, an ice-bag may be placed over the vesical region during the first twenty-four hours. The patient should be kept quiet, but if the peritoneal cavity has been closed by suture, she can lie on either side, as she prefers, with the understanding that she is not to turn herself and is not to be turned oftener than every hour or two. The so-called gas pains are relieved by enemata of glycerin and water, equal parts.

If a gauze packing has been left in the vagina, which is usually the case, an inch or two of each strip of gauze should be pulled out of the vagina and cut off after every urination. If a retroversion has been corrected, not more than six ounces of urine should be allowed to accumulate in the bladder.

After the gauze has been removed douches should be given every eight or twelve hours. I use a 1 per cent. carbolic douche as a routine.

TREATMENT OF COMPLICATIONS.

Oozing from the intraperitoneal or cellular spaces can often be managed successfully by a tampon of strips of nosphen or sterile gauze. Slight ele-

vation of the foot of the bed, an ice-bag on the lower abdomen, and, if necessary, pieces of ice placed in the vagina and renewed frequently will usually check or restrict the hemorrhage unless from a good-sized artery.

Post-operative septic accumulations can, as a rule, be evacuated by vaginal incision made under an anesthetic, or by pushing the finger through the original incision.

Internal hemorrhage of a serious character, and not controlled by the treatment recommended, calls for an abdominal section.

Ileus, or serious intestinal paralysis, is best relieved by an early abdominal section. A reopening of the vaginal wound would, in most cases, be objectionable, because the condition of the parts cannot be seen and a promiscuous manipulation would probably promote inflammation and sepsis.

PROGNOSIS.

The prognosis of vaginal celiotomy is much more favorable than would be expected when compared with abdominal section. Dührssen lost 15 cases in his first 503, a mortality of less than 3 per cent. Martin reported 131 cases of vaginal ovariectomy with 2 deaths. The author performed his first 115 vaginal sections for all causes with 1 death (exclusive of hysterectomies). Of these, 106 were for the removal of tumors and ovaries or parts of ovaries, and 2 for the separation of adhesions, making 108 cases belonging to this subject without any deaths. The death took place in a case in which the ovaries were not operated upon.

It is to be supposed that these results of early operations quoted above represent at least the full mortality of experienced operators of today and are not much better than the general mortality will be hereafter.

With regard to the curative value of peritoneal operations performed through the vagina, the results in properly selected cases are fully as good as by abdominal section, and the convalescence is a more rapid and comfortable one.

The danger comes from an imperfect technic and an improper selection of cases. With the right methods, appropriate instruments, skill and carefulness in the separation of adhesions, and ligating of the pedicles, and care not to leave any undrained pockets of bloody serum in the peritoneal cavity, the mortality should be very small.

The patient's desire to avoid the abdominal incision should not influence the operator to attempt to do by way of the vagina what can be done as safely and better through an abdominal incision.

A very long vaginal operation in a weak patient with imperfect hemostasis and uncertainty as to the possibility of doing good work, may be more dangerous than an abdominal section.

The greatest danger has proved to be from hemorrhage, although by careful operation and the use of intraperitoneal gauze tamponade and ice-bags, I have avoided deaths from this cause.

Ileus, or intestinal paralysis, is to be feared when large denuded surfaces are

in contact with intestines, or when gauze is left protruding upward into the peritoneal cavity. The death in my series was from a localized peritonitis about the uterovaginal junction, after suture of the uterus over the bladder, and consequent intestinal paralysis. Septic changes in effused blood killed four of Dührssen's cases of anterior colpotomy. In posterior colpotomy death seldom results from this cause because the pus finds its way out through the cul-de-sac of Douglas and posterior vaginal incision.

(For greater detail with regard to pathology, diagnosis, after-treatment, complications, etc., the reader is referred to the chapters elsewhere in which these subjects are discussed.)

CHAPTER XVI.

REMOVAL OF THE UTERINE APPENDAGES.

BY J. CLARENCE WEBSTER, M.D.

History.—The operation for the removal of the ovaries is by no means a modern one. It has been practised during many centuries and in different countries, as ancient Egypt, Lydia, India, Australia, etc., in connection with religious or ceremonial rites or with peculiar social customs. Only in very recent times has it been employed therapeutically, the earliest authentic records being those of cases in which the ovary was removed from a hernial sac, the operation being usually unilateral, very rarely bilateral.

Hunter, in the last century, proposed the removal of the organ in early cystic degeneration, believing that a woman could stand castration as well as animals.

The first suggestion of the operation in relation to the diseased conditions for which it is employed at the present day was conceived by James Blundell. In 1823, in a communication to the Royal Medical and Chirurgical Society of London, he advocated double oöphorectomy for severe dysmenorrhea and for the bleeding occurring in cases of inverted uterus where extirpation could not be carried out. His proposals were never put into actual practice.

Esmarch first removed both ovaries in a case of mal-development of the vagina, because at each menstrual period they descended into the inguinal canals and caused great suffering. Lawson Tait did the operation on account of pelvic pain in 1871. It was not until the year 1872 that the operation began to be recognized as one which might possibly be beneficially employed.

The honor of having first developed this idea and of having advocated it in the face of indifference and opposition belongs to Robert Battey, of Rome, Georgia, although it must be admitted that Hegar, of Freiburg, was thinking on similar lines, though independently, about the same time. Indeed, the latter surgeon was actually first in carrying his idea into practice. He operated in July, 1872, removing both ovaries on account of pelvic pain and dysmenorrhea, and found them diseased. The patient died of sepsis and Hegar did not publish an account of the case for several years.

Battey operated successfully on a similar case in August, 1872, publishing an account of it in September.¹ In the same year Lawson Tait removed the ovaries and tubes of both sides to check hemorrhage in a case of uterine fibroid.² Peaslee was the first to recommend double oöphorectomy for mal-developments of the uterus.

¹ Battey, Robert: "Normal Ovariectomy Case," *Atlanta Med. and Surg. Jour.*, September, 1872, vol. x, No. 6, p. 321.

² Tait, Lawson: "Diseases of Women and Abdominal Surgery," *Phila.*, 1889, vol. i, p. 194.

It was not until 1876 that any marked attention was given to these operations. Fresh interest was created by the work of Trenholme, of Montreal, who removed the ovaries in a case of uterine myoma in January, 1876, and also by that of Hegar, who operated in two similar cases in August of the same year.¹ The removal of diseased tubes as a distinct operation was carried out by Hegar and described by him under the name of salpingotomy in 1877.²

The following terms have been given to the various operations mentioned:

<i>Removal of Ovaries.</i>	<i>Removal of Ovaries and Tubes.</i>
Castration.	Extirpation of appendages.
Spaying.	Oöphorosalpingotomy.
Normal ovariectomy.	Salpingo-ovariectomy.
Ovariectomy.	Salpingo-oöphorectomy.
Oöphorectomy.	Oöphorosalingectomy.
Batley's or Hegar's operation.	Tait's operation.
	<i>Removal of Tubes.</i>
	Salpingotomy.
	Salpingectomy.

Conditions under Which These Operations May Be Carried Out.—There are differences of opinion among authorities as to the indications for these operations, and to speak dogmatically on the subject would be out of place. There can be no doubt that for a number of years they have been far too extensively and recklessly employed. As early as 1881 Batley's voice was raised in the International Congress in London protesting against the abuse of the operation associated with his name. In many quarters in recent years similar protestations have been made. The reasonableness of the present tendency toward conservatism is evident in the light of physiologic, pathologic, and clinical investigations. By the former of these, it has been shown to be extremely probable that there is an internal secretion of the ovary which exerts a strong influence on bodily metabolism, and that in consequence the removal of these organs during the reproductive era may cause more or less serious disturbances.

Pathologic inquiry has enabled the operator to distinguish more accurately between the serious, the trivial, and the important (though much remains to be done in this category), and so to exercise a wiser discretion in his manipulations. Clinical study has shown that in many cases these mutilating procedures have served in no measure to give relief, often, indeed, being followed by an aggravation of old symptoms or by the development of new ones. This remark applies chiefly to a certain class of cases in which operation is undertaken for the relief of the pelvic pains.

¹ Hegar, Alfred: "Die Castration der Frauen," Volkmann's Sammlung, klin. Vorträge, Gynäk. Nr. 42, S. 925.

² *Ibid.*: "Ueber die Extirpation Normalen und nicht zu umfänglichen Tumoren degenerierten Eierstöcke," Centralbl. f. Gynäk., Jan. 19, 1878, Nr. 2, S. 25.

Hitherto there has been a widespread tendency in the operation for the removal of a diseased ovary to take away with it the corresponding tube; and *vice versa*, in dealing with a diseased tube, to remove the corresponding ovary under the mistaken view that the one without the other is useless. Such a custom is not justifiable, save when it is impossible to remove one without the other, for the following reasons: The tube without the corresponding ovary is still functional and may serve to conduct an ovum from the opposite ovary to the uterus. That this is the case has been shown by experiments on animals and by observation in the human female. The ovary without the tube of its own side is of greatest value to the system because of the influence on body metabolism and because it can produce ova which may enter the uterus by way of the opposite tube and become fertilized.

Again, it has been generally the custom in certain cases in which only a part of the tube or ovary is affected to remove the entire structure. At present there is a reaction against such a procedure, for it has been shown that a small portion of the ovary is as valuable to the organism as the whole structure, and that a short piece of tube may be of service in conveying an ovum to the uterus. Hence there is developing a new sphere of work, viz.: the conservative surgery of the ovaries and tubes, which will doubtless render the necessity of carrying out radical measures less frequent. (See Chapter XXIV.)

On account of the additions which are being made to our knowledge, an exact delimitation of the sphere of employment of the various operations which I have mentioned cannot be established. Each one must be carefully considered by itself.

OÖPHORECTOMY.

(a) WHERE THE OVARIES ARE HEALTHY.

1. *In Cases of Dysmenorrhea.*—Ever since Battey's operation became well established, it has been widely used as a means of treating pains associated with menstruation. In the cases in which no pelvic pathologic changes can be made out, this method has proved to be very often useless. The pains may be in no way alleviated or the patient may become worse after the operation. The pathology of the so-called "ovarian dysmenorrhea" is not fully understood. For a long time it was supposed to be due to difficulty in the escape of the ovum. Now we know that ovulation and menstruation are often not coincident phenomena, and that this form of dysmenorrhea may occur quite apart from the shedding of a ripe ovum. Indeed, the most careful microscopic examination of ovaries removed in these cases may reveal no abnormality. It is extremely likely that in many cases the pain is a neurosis.

It may be associated with other neurotic phenomena, but may sometimes be the only one present. In some instances the condition may be that in which the possession of a "fixed idea" is characteristic. A most striking example is the following: A young woman, troubled with such localized pain, consulted a surgeon, who removed the ovary and tube on the affected side. There was no improvement

and he removed those on the other side, with the same result. He then extirpated the uterus, without relieving the woman of her complaint.

In other cases the pain is of the nature of a "secondary reflex action" induced by a former continued pain due to some pelvic lesion which has since been cured. The patient's nervous system has so registered the former habit that it is reproduced apart from all control of the higher inhibitory centers. That cure sometimes follows oöphorectomy is true, the explanation being, probably, that the operation has made a powerful impression on the patient, acting on the dominant control centers, and through them on the whole nervous mechanism of the body. The same result may sometimes be obtained by the mere exploratory incision, nothing being removed. Some of the worst cases may be cured by hypnotism.

The removal of healthy ovaries for pelvic pain cannot any longer be considered justifiable. It must be remembered that the determination of the normal by physical examination, even under anesthesia, is not always possible. Nor is it easy even during operation, when the organs can be viewed and handled. One reason for this is the normal range of variations in size, shape, and consistence of the ovary—a fact not sufficiently recognized.

The mistake is often made of regarding a large ovary as one swollen from inflammation, or a very small one as an atrophied and cirrhotic organ, just as, on the other hand, these very conditions may sometimes be mistaken for ovaries of abnormal size, but of normal structure. On the other hand, it must be pointed out that marked pathologic change may be present in the ovary, viz.: the condition of small cystic degeneration without any alteration in the size or consistence of the organ which is recognizable by bimanual examination. Where no adhesions are present such cases may often be diagnosed as normal.

2. *In Prolapse of the Ovary.*—This condition, especially when occurring in the pouch of Douglas, is sometimes the cause of much distress—radiating pains, pain on defecation and coitus, dragging sensation, or reflex neuroses. It is very doubtful if simple prolapse unaccompanied by inflammation in or near the ovary is ever the cause of these symptoms. Certainly in many instances the condition may exist without distress. The possibility of the symptoms being purely neurotic in some cases must be kept in view.

For the cases in which symptoms are not improved by minor treatment, removal of the ovary has been carried out. Such a course can no longer be advised, except in cases where marked inflammatory changes exist. When the prolapse exists alone, an operation for raising it, such as that devised by Sängner, may be carried out. If, as is often the case, retroversion of the uterus be present, rectification of the latter condition should also be carried out. If there be ovaritis as well, a resection may be carried out with advantage.

3. *In Hernia of the Ovary.*—The ovary may be found in an abdominal, femoral, gluteal, or inguinal hernia. The latter is the most frequent and need alone be considered. Most cases occur in early youth, being usually congenital, others being sometimes acquired. Usually the discovery of the condition is not made until puberty,

although it may become strangulated and cause trouble at an earlier date. The ovary may be herniated alone or along with the Fallopian tube, uterus, cornu of a bicornuate uterus, bowel, or omentum. Sometimes the condition may be bilateral.

In some cases there may be no special symptoms if the ovary can move freely in and out of the hernial sac. There is increased sensitiveness from time to time, and often during menstruation. The symptoms are worse when the hernia is irreducible, when adhesions are present, or when pathologic changes occur in the organ. Removal of the organ is only necessary under the latter conditions. If it be not diseased, an abdominal incision should be made, the ovary replaced in the pelvis, and the abdominal wall thoroughly repaired.

4. *In Osteomalacia*.—It is now well recognized that removal of the ovaries tends to check the progress of this disease. Before the year 1887 a number of cases were reported as cured after the performance of Porro's operation. Fehling, believing that the beneficial result was due to removal of the ovaries, operated successfully on a case for the first time in 1887. Since that time he has reported a considerable number of cases.¹ His example has been followed by many other operators. Truzzi in 1894² reported operations on 97 women. In 52 of these observations were made as to the ultimate results, as follows:

Complete cure.....	36	Improvement.....	3
Almost complete cure.....	4	Continued relapse.....	5
Cure after relapse.....	3	Unchanged.....	1
	<u>43</u>		<u>9</u>

It has been said that the Porro operation is more successful, but Ritchie, in his elaborate monograph ("Osteomalacia," Edinburgh, 1896), states that this is not true. He also shows that while improvement may follow the Cesarean operation, relapse almost always takes place. It may, therefore, be regarded as advisable to remove the ovaries alone in operating in the non-pregnant condition, and to remove both uterus and appendages when the patient is pregnant.

The rationale of the improvement is not clearly known. Fehling believes that the ovaries are the seat of pathologic activity, causing reflex dilatation of the bone vessels, which is followed by resorption of the osseous elements. Curatulo³ thinks that an ovarian secretion leads to oxidation of the phosphoric organic compounds which help to form the bone salts, castration being followed by a marked diminution in the excretion of the salts.

5. *In Distant Carcinoma*.—Recently Beatson, of Glasgow,⁴ has introduced the operation of oöphorectomy in inoperable cancer of the mamma. It has also been tried in similar growths in other parts—*e. g.*, the uterus. Although undoubtedly in

¹ Fehling, A.: "Ueber Wesen und Behandlung der puerperalen Osteomalakie," *Archiv für Gynäk.*, 1891, Bd. xxxix, H. 2, S. 171. *Ibid.*, "Weitere Beiträge zur Lehre von der Osteomalakie," 1895, Bd. xlviii, H. 3, S. 472. *Ibid.*, "Ueber Osteomalakie," *Zeitschr. f. Geb. u. Gynäk.*, 1894, Bd. xxx, Nr. 9, S. 471.

² Truzzi, Ettore: "La Castrazione nell' Osteomalacia," *Annali di Ostetricia*, Oct., 1894, p. 768.

³ Curatulo, Emilio: "On the Influence of the Removal of the Ovaries on Metabolism," *Obstet. Trans.*, Edinburgh, 1894-95, vol. xx, p. 123.

⁴ Beatson, Geo. T.: "On the Treatment of Inoperable Cases of Carcinoma of the Mamma," *Trans. of Med. Chirurg. Soc.*, Edinburgh, 1895-96, vol. xv, p. 153.

some cases retardation of the growth or actual shrinkage has been noted, sufficient observations have not been made to enable any definite opinion to be given regarding the efficiency of the operation.

6. *In Certain Mental and Nervous Disturbances.*—One of the sorriest chapters in medical literature is that which deals with the relationship between the female pelvic viscera and the brain and nervous system in health and disease. Harm has undoubtedly been done by the failure of the general physician to appreciate the significance of the local pelvic phenomena, but it is not to be compared to the evil which has followed the gynecologist's error in wrongly estimating their proportional values.

Attempts have recently been made in various quarters to introduce gynecologic procedures in the treatment of various forms of insanity. Regarding this subject in its general aspect, nothing can be said in this work. It is sufficient to state that an overwhelming mass of evidence from American alienists goes to show that the pelvic organs in the female are very unimportant factors in the causation of mental disorders. (An able *résumé* of this evidence is given by James Russell in the "Canadian Practitioner," October, 1898, vol. xxiii, p. 577.)

Special notice need only be given to the question of removal of ovaries in certain neuroses. As far as the best opinions go, it may be safely stated that these organs almost never require to be interfered with, in their normal state, in such conditions. Attention has been called to the unsatisfactoriness of performing oöphorectomy when the neurosis takes the form of pain. It has been no less marked when carried out in hysteria, epilepsy, hystero-epilepsy, mania, melancholia, masturbation, nymphomania, etc. *A priori* it might be expected that the induction of the menopause would lead not to diminution or cessation of nervous phenomena, but rather to their development or intensification; and, indeed, the latter is often found to occur.

Probably the only cases in which oöphorectomy has any claim for consideration are those in which the mental or nervous disturbances are associated with menstruation, and which, after the failure of therapeutic measures, are recognized to be sufficient to make the patient very miserable. Some successful cases have been reported,—hystero-epilepsy, hysteromania. That such success is due to removal of the ovaries is by no means certain. It may be due to the general operative procedure, since it is well established that the insane habit may be markedly improved by a shock, sudden change of life, acute disease, etc.

Regarding operations in true epilepsy only failure can be chronicled. S. Weir Mitchell says that he has never known oöphorectomy to cure the disease ("Univ. Med. Mag.," March, 1897, p. 388). The attempt to cure masturbation and erotic tendencies by this operation must be regarded as useless and unscientific, since these manifestations are the result of changes in the central nervous system, not in peripheral parts.

The question of treating diseased ovaries in mental and nervous disorders is another matter altogether. Though there are some who would not think it wise to subject insane women to serious operative procedure, a large number think it right, quite apart from the mental condition, to treat them just as sane women should be treated.

7. *Certain Conditions of the Genital Tract in which Retention of Menstrual Blood Occurs.*—In any case in which a congenital or acquired stenosis or atresia exists and in which there is danger of an accumulation of menstrual blood above the contracted point, double oöphorectomy may be carried out if the condition cannot be safely treated by enlarging the passages so as to allow a free outlet. If a woman should be in such a position as to become pregnant, it might sometimes be justifiable to prevent conception under the unfavorable circumstances by performing castration. An example of this is the case of a woman whose vagina became greatly contracted as the result of cicatrization produced by a scalding douche in the puerperium. It was impossible to dilate the passage afterward so as to insure safety in delivery and the woman desired to have the ovaries removed rather than run the risk of a Cesarean section.

Apart from the above conditions it is doubtful if there are other indications in connection with malformations of the genitalia pointing to the removal of the normal ovaries. Pain and various neurotic disturbances found in some cases after puberty are probably not due to the normal ovarian function taking place in association with the malformed structures, but to local disturbances—inflammation in or around the ovaries, ovarian, tubal or other diseased conditions; to general ill health or disturbed innervation, etc. In such cases the most careful investigation should be made before operative measures are decided upon.

The Operation.—This may be carried out by both the abdominal and vaginal routes. The choice of method is a matter of individual taste. The former is undoubtedly most convenient for all cases, though there are many instances in which vaginal section proves satisfactory. The latter method is associated with less disturbances to the patient and is not followed by external signs of scarring; on the other hand, in many cases, it does not allow of such satisfactory manipulations as does the abdominal section. As far as statistics go, it is difficult to say which is the safer method.

1. *By Abdominal Section.*—The patient is placed in the Trendelenburg position and the abdomen opened in the middle line above the pubes for a distance of 7 cm. (3 in.); this may be enlarged if necessary. (When the ovary is in an inguinal or femoral hernia, the incision is made over the latter.) The intestines are carefully pushed upward from the region of the pelvis and a double or triple row of sterile gauze pads placed transversely from one iliac fossa to the other, to prevent the gut from descending into the field of operation, and to absorb blood and other discharges which may escape during manipulations. The packing serves also to prevent the radiation of heat from the intestines. The first two fingers are then introduced and passed down behind the pubes until the fundus uteri is reached; they are then moved along the broad ligament until the ovary is felt. This procedure may also be carried out by first placing the fingers on the infundibulopelvic ligament and then moving them inward toward the ovary. The latter, along with the corresponding tube, is raised into the abdominal incision. The infundibulopelvic ligament and the ovarian ligament are held with forceps by an assistant, who at the same time

compresses the ovarian artery. The ovary is then cut away from its attachment to the broad ligament and the denuded surface left thoroughly obliterated by a continuous catgut suture; in this way, usually, all bleeding is checked. If there should be troublesome oozing a separate ligature may be applied to the infundibulopelvic ligament so as to control the ovarian artery, or one may also be applied internal to the site of the ovary to secure branches of the uterine artery anastomosing with the ovarian. The pelvis is next carefully sponged, the abdominal pads removed, and the abdominal incision closed.

This operation is the most satisfactory because the denuded surface is entirely covered with peritoneum and the risk of after-adhesion of bowel greatly lessened.

The following method is employed by some operators: The ovary is pulled from



FIG. 309.—REMOVAL OF DISEASED OVARY—OÖPHORECTOMY.

a, Denuded area from which the ovary has been removed; b, deep ligatures securing the vessels divided; c, continuous catgut suture used to approximate the edges of the divided peritoneum.

the broad ligament so as to stretch the posterior layer of the latter at the hilum, forming a pedicle. This is then secured with the two interlacing catgut sutures or by means of the Staffordshire knot (page 628), and the ovary is cut away, leaving a small stump.

The chief objection to this method is that a raw stump is left, which may become adherent to intestine. Another danger is that retraction of the tissues in the pedicle may occur after operation, leading to hemorrhage.

2. *By Vaginal Section.*—The peritoneal cavity may be entered by an anterior or posterior colpotomy. If the ovary can be pulled down easily it may be removed by either of the procedures just described. If it cannot be brought down satisfactorily, the vaginal opening should be closed and the abdominal operation

carried out. The vaginal route should not be selected when the vagina is long, narrow, rigid, or contracted, nor when the uterus cannot be pulled well down.

(b) WHEN THE OVARIES ARE DISEASED.

Ovaritis, Oöphoritis.—Inflammation of the ovary may occur alone or along with changes in neighboring structures.

The most important cause is microbial infection. Thus it may follow abortion and labor, or operative procedures on the genital tract. It may form part of a general peritonitis due to the colon bacillus, streptococcus, or other organisms. It may be caused by tuberculosis and actinomycosis. It may follow appendicitis, acute gonorrheal infection, or may result from old-standing gonorrheal trouble in the male. It may develop in the exanthemata, in arsenic- and phosphorus-poisoning, or be secondary to parotitis or other distant infections. Exposure to cold and damp, excessive coitus at or near menstruation, are believed by some to be occasional causes.

Pathology.—The process may be an acute or a chronic one. It may affect both follicles and stroma; usually both are implicated, though in different degrees in different cases. Generally in acute cases the former are markedly affected. The ovary gets larger, the Graafian follicles swell, their contents become cloudy, the cells of the membrana granulosa and discus proligerus degenerate, and the ovum breaks down. On the surface of the organ the germ epithelium may become greatly destroyed. The vessels are congested and exudation takes place into the tissues, and small ecchymoses may form. Pus may develop and may give rise to one or more abscesses.

An ovarian abscess may grow as large as an egg, or, more rarely may reach a larger size. It is usually associated with periovaritic adhesions. It may communicate with the Fallopian tube or may rupture spontaneously into bowel, bladder, vagina, or through the abdominal wall; it may also burst into the peritoneal cavity. In some cases it remains for a long time as a localized swelling.

In chronic inflammation, where there is no pus formation, the ovaries are enlarged and congested; many Graafian follicles become compressed and destroyed, though some get distended to form small cysts. Often the gland may be changed into a mass of small irregular cysts, almost all the intervening stroma having become atrophied and destroyed. This condition may be found without any enlargement of the ovary as a whole. In some cases the organ gets much swollen and edematous—"oöphoritis serosa." In some old-standing conditions of interstitial ovaritis the ovary becomes hard and cirrhotic owing to fibrous changes in the stroma, and it may be considerably reduced in size. In tubercular inflammation miliary tubercles may be found on the surface or in the substance of the organ; the latter may lead to caseation.

Diagnosis.—When acute ovaritis is but part of a more widespread inflammation, it is usually impossible to determine definitely the involvement of the affected organ. When the disease is localized to the ovary the symptoms are very much like those

found in other local pelvic inflammations. They vary greatly in different cases according to the variety and degree of inflammation and the nature of the patient. In acute cases there is pelvic pain in the region of the inflamed organ which may radiate to different parts. On bimanual examination the ovary is painful to the touch and may be found to be enlarged.

In chronic cases there are local pains. Ill health and neurotic manifestations tend to develop. Dysmenorrhea is found in some cases, most marked during the first day or two of the menstrual period. In other cases there is no increase in pain at this time, while occasionally there may be a lessening of the suffering. As regards the menstrual flow there is no alteration which can be considered as characteristic of ovaritis. Menorrhagia, or scanty menstruation, may be met with, but its occurrence probably depends largely upon the state of the uterus and on the general health.

On bimanual examination the tender organs may sometimes be distinctly felt; in most cases, owing to surrounding inflammation and to adhesions to neighboring structures, their outline cannot be defined. When a pelvic abscess is present, it is felt either as a firm or as an elastic mass. Very rarely can any fluctuation be detected. When large it may occupy a considerable part of the pelvic cavity, displacing and compressing the pelvic contents.

Indications.—Until the present conservative era in operative gynecology began, one of the commonest indications for oöphorectomy was ovarian inflammation, and there can be no doubt that ignorance of the pathology of this condition has led to wholesale and unnecessary mutilations. The hasty and reckless diagnosis of the operator on opening the abdomen had often been the sole basis for the radical measures which followed. A few small cysts in the ovary sufficed to warrant its removal. Variations in size from some text-book standard were even regarded as indications, it never having been widely recognized that the normal ovary may vary in size as well as the ear or nose or any other part of the body. "Cirrhosis of the ovary," a term applied to an appearance supposed by many to be advanced oöphoritis necessitating removal, is now shown to be an expression covering a variety of conditions—premature senile change; excessive superficial fissuring due to developmental peculiarity, or to the cicatrization following bursting of numerous Graafian follicles; shrinkage following constriction of neighboring tissues by inflammatory bands. As an alteration following old-standing oöphoritis it is not very common.

It is, indeed, only now that gynecologists are finding out that the necessity for performing oöphorectomy in inflammatory conditions is comparatively rare, the conservative procedures of freeing the ovary from adhesions, incisions, ignipuncture, and resection taking its place in a large number of cases. The recognition of the part that the neurotic element plays in giving prominence to pelvic pains in women has been an important factor in modifying operative treatment.

In view of these facts the operative treatment of ovarian inflammation must be regarded as being in a transition state, so that it is impossible to lay down exact indications for the performance of oöphorectomy.

Non-purulent Chronic Inflammation.—Removal is sometimes necessary in this condition. It is indicated in two classes of cases: First, those in which the ovary is embedded in dense inflammatory tissue so that it is impossible to free the organ, without tearing it to pieces; second, those in which a chronic inflammatory process is accompanied with the transformation of the Graafian follicles into small cysts so that the whole ovary is filled and distended by them. The importance of the small cystic degeneration into the ovaries has been much exaggerated, and until recently the presence of a moderate degree of this change was considered sufficient to warrant removal of the organ. Owing to the conservative views of Martin, Polk, Pozzi, Dudley, of New York, and others, the radical operation is being replaced by incision, ignipuncture, and resection in chronic oöphoritis with cystic changes. There is some difference of opinion regarding the nature of the so-called "small cystic degeneration of the ovary," but the work of Bulius, Steffeck, Stratz, Petitpierre, Popoff, Hölzl, Martin, and others, proves that in the great majority of cases in which it is well marked, the change is due to chronic inflammation. There is an increase in the *liquor folliculi* by transudation of fluid from the perifollicular vessel, as well as by the breaking down of the cells of the *membrana granulosa*, the ovum being destroyed. The follicle wall is thickened by the inflammation and so there is increased resistance to the escape of its contents. The shape of the ovary may often be altered and various degrees of enlargement may be found. The cysts are of different sizes and tend to be irregular in shape, especially when numerous and pressed together. In the latter condition in advanced stages, there may be such stretching and thinning of the interfollicular stroma as to obliterate the ordinary signs of the inflammatory process. In less marked cases congested vessels are noted, extravasation of leukocytes and sometimes of blood. In advanced conditions thickening and hyaline degeneration of vessel walls are found. When only a few small cysts exist in an ovary, it may be very difficult, on naked eye examination, to decide as to their nature. If they be few in number, entirely superficial, distinct from each other and rounded in shape, they are to be regarded as probably only enlarged normal follicles. The cyst fluid presents different appearances. In small cavities it is usually thin and transparent; in older ones it is often whitish and opaque. It may sometimes be blood-stained, brown or yellow. If the cysts are distributed irregularly through the organ or are pressed together in parts having irregular outlines, they are probably of pathologic origin. Hölzl has pointed out the tendency of these to lose their round shape at an early period. In any case of doubt one or more incisions may be made in the ovary for the purpose of examining the condition of the organ. If it be normal the wounds may be easily closed with fine catgut. In purulent inflammatory conditions—ovarian abscess—removal of the whole organ is usually necessary. An exception to this rule may sometimes be made when the abscess is single and the contents sterile; the diseased part may then be resected. Or in some cases when the abscess is large, and bulging down against the vaginal roof, perforation of the latter and drainage may be sufficient (see Chapter XVIII).

Nature of Operation.—The removal of a diseased ovary may be carried out

by both abdominal and vaginal section. In most cases the former route is to be chosen because of the frequency of adhesions in these cases and of the better opportunity afforded for dealing with the condition.

The operation may sometimes be as simple as that described for the removal of the healthy ovary. Often the presence of periovaritis binding the ovary to neighboring structures causes trouble and difficulty. The stages of the operation are those already mentioned in describing normal oöphorectomy. The method of dealing with difficulties in the operation will be considered in connection with salpingo-oöphorectomy.

Hematoma of the Ovary.—The etiology and pathology of this condition are not well known. It is found in different forms—hemorrhages into the stroma, into Graafian follicles, and in cysts. Hemorrhages into ovarian cystomata will not be considered.

Oöphorectomy is very rarely required for this condition; only when the hematoma has so distended the ovary as practically to destroy the normal tissues. In other cases where the mass is not so large it is sufficient to remove the clot and to close the cavity with a continuous catgut suture.

SALPINGECTOMY.

Conservative tendencies have likewise begun to reduce the sphere of this operation, since it has been shown that in many cases of tubal disease resection may serve to preserve a portion of the tube capable of carrying on its normal function. The most frequent indication for removal of the tube is inflammation, and the operation has hitherto been carried out in all varieties and stages.

Salpingitis.—The etiology of this condition is practically the same as that already described in connection with inflammation in the ovary. The most important causes are gonorrhea and sepsis.

Pathology.—The most marked alterations are found in the mucosa, but all parts of the wall are usually more or less affected at the same time. When the peritoneal covering is involved, the inflammation may be localized or may be part of a wider affection. As a result the tube may be constricted, bent, displaced, or made adherent to surrounding parts. Very often the ovary is involved with it. The outer end may become closed, the fimbriæ adhering. In some cases there may be a considerable thickening of the subperitoneal cellular tissues.

In the muscular part of the wall there is small cell infiltration, making it thick and hard. When pus is present, small loculi may be formed throughout it. When the mucosa is affected various changes are caused. Infiltration and effusion take place into the delicate submucous layer. The vessels are congested and small hemorrhages may take place.

Abundant mucus is secreted in the lumen; leukocytes and sometimes red blood-corpuscles may enter it, and epithelial cells intact or degenerate may be thrown off. The epithelial layer may be lost in some parts, and adhesions may form between the

plicæ. The latter may become thickened so as to resemble polypi; they may also become covered with vegetations. As a result of the formations of adhesions, occlusion of the tube may be caused in one or more parts. Suppuration may occur in one or more areas.

In the cases in which a chronic interstitial process is the main one, the tube may become hard, thick, and irregular. In advanced stages it may become atrophied and cirrhotic. The lumen may be obliterated partly or entirely by adhesions and the unobliterated portions may become distended with fluid.

Hydrosalpinx.—This is a distended condition of the tube as a result of serous fluid poured into the lumen. It is probably always due to inflammation, and sometimes may be an advanced stage of pyosalpinx; in some cases the wall shows few traces of inflammation. It may develop on one or both sides of the pelvis. The outer end of the tube, and generally the inner, are closed. As distention takes place the tube becomes elongated and pear-shaped, somewhat tortuous, and, as a rule, marked by constrictions. The surface is smooth, save where there are adhesions, and has a pearly gray color; the walls are thin and translucent. The fluid is usually thin and citron-colored; sometimes it may contain flakes of lymph or a little blood. The lumen is usually single, but may contain one or more complete or partial septa.

The mucosa becomes very thin as the tube distends, the plicæ becoming more or less obliterated in many parts and separated from one another. The epithelium may be preserved to a large extent, although the cells may be somewhat altered in shape. The muscular coat is greatly atrophied in marked cases. Sometimes the distended tube has a narrow pedicle owing to rotation. The uterine end may not be completely closed in some cases but only stenosed, so that the fluid may escape at times into the uterus—the condition known as “hydrops tubæ profluens.”

Pyosalpinx.—This is a condition of the tube usually produced by purulent salpingitis, as a result of which gradual distention tends to occur. It may also develop by the infection of a tube already distended with serum or blood. The rate of distention varies greatly in different cases. Sometimes it may take place rapidly; in other cases very slowly. The enlargement may be uniform, but generally the tube wall is somewhat constricted in parts; occasionally more than one distinct collection of pus may be found. The least marked change is usually in that part of the tube next the uterus.

In moderate degrees of distention the enlargement is somewhat pear-shaped. In extreme degrees it becomes more rounded, and may extend considerably above the pelvic brim, reaching the size of an infant's head. The wall varies in thickness and is usually adherent to neighboring structures. The adhesions may be so abundant as to embed the tube as a fixed mass whose contour cannot be distinguished. It may lie lateral to the uterus, in front, above, or behind it. Most commonly it is found between the broad ligament and the sacrum, extending deeply into the pouch of Douglas.

The fimbriated end is rarely free, the fimbriæ being matted together and generally adherent to some neighboring structure. The mucosal folds tend to be-

come obliterated as distention occurs, the inner surface of the wall having the ordinary appearance of the lining of any abscess cavity. The lining epithelium is largely destroyed, but may be found in places, especially in the depressions between the mucosal folds, though even here it is usually altered.

The pus is generally thick and yellow. In old cases it may become a thin, watery fluid in which flakes of pus and lymph may be found in large or very small quantities. In some cases the odor is fetid, especially when the sac is adherent to intestine.

Rupture may take place into the peritoneal cavity, rectum, bladder, vagina, or through the abdominal wall. Sometimes it may burst among adhesions, the pus burrowing in various directions. In a large percentage of cases the fluid in these distended tubes is sterile, the microorganisms which caused the disease having been gradually destroyed. Of the microbes which may be found in some cases, the gonococcus is the most frequent; streptococci are found in a few instances and staphylococci very infrequently. Rarely the colon bacillus, tubercle bacillus, micrococcus lanceolatus, bacillus aerogenes, and proteus Zenkeri may be found. Mixed infection occurs occasionally.

Sometimes the ovary becomes infected along with the tube, adhesions forming between both, a single pus cavity being formed—the tubo-ovarian abscess. This condition may also develop from a preëxisting ovarian hydrocele or tubo-ovarian cyst which has become infected.

Symptoms and Diagnosis.—It is not easy to present a clear account of the symptomatology of salpingitis, especially in relation to the different varieties. In both acute and chronic cases there is often an accompanying inflammation in neighboring tissues, so that it is difficult to assign to each structure its proper share of symptoms. In acute cases at all marked there are the usual general disturbances due to the febrile state and there is local pelvic pain. Often, owing to widespread abdominal tenderness and tympanites, a wrong diagnosis of general peritonitis may be made. When on the right side, the condition may be mistaken for appendicitis. As the disease continues the acute stage gradually passes into the chronic, the latter varying in different cases. Pain continues on the affected side and is generally constant, though sometimes intermittent.

In purulent salpingitis exacerbations may be caused by the escape through the tube wall of drops of pus, setting up localized peritonitis. Pain is aggravated at menstruation and after coitus and exertion. Menorrhagia and metrorrhagia are often present, but are probably due to coincident disease in the endometrium. Defecation is often painful when an enlarged tube is adherent to the rectum. When the disease is marked and bilateral, sterility results. In many cases reflex pains are established and various neurotic phenomena may develop, ill health continuing for a more or less extended period.

In advanced degrees of tubal distention the symptoms are variable. There may be no symptoms in some cases, or they may be slight. The pain may be entirely caused by surrounding inflammation. Pressure symptoms are often found re-

lating to bowel, bladder or other structures, especially when the enlarged tube is firmly fixed by adhesions.

In the case of hydrops profluens there may be an occasional noticeable discharge of fluid into the uterus and vagina. If rupture of a distended tube takes place into the peritoneal cavity, the symptoms vary according to the virulence of the contents. In severe cases acute peritonitis may be set up. When the contents are sterile there may be no symptoms whatever. Rupture into the bladder, vagina, or rectum may be followed by an improvement in symptoms; a fistulous tract may be left which may continue to discharge, remaining a source of distress and weakness.

Physical Signs.—Deep pressure in the iliac region of the affected side causes tenderness and resistance. When the tube is much enlarged it may sometimes be felt through the abdominal wall. The diseased condition is best made out on bimanual examination, when the swelling may be easily palpated, the patient usually complaining of pain. When there is inflammatory thickening near the tube it may be impossible to distinguish the latter with accuracy unless it be considerably enlarged.

The distended tube may in some cases be felt as an elastic mass; in other cases as a firm swelling lying lateral to, above, or in front of the uterus, which may be much displaced. The mass may be movable, but is generally fixed. When both tubes are distended they may sometimes be palpated independently, especially by a finger passed well into the rectum. In many cases this is impossible when they lie in the pouch of Douglas close together and surrounded by adhesions.

It is important to bear in mind that all manipulations should be carried out gently in examining these cases. Thin-walled distended tubes may easily be ruptured. Sometimes the fluid is forced from the tube into the uterus and vagina by the bimanual examination.

Indications and Contraindications.—The removal of the tube, in all degrees of inflammation, has been carried out with far too great freedom in recent years. Since it has been shown that resection may be safely employed in many cases where complete removal was formerly thought necessary, operators are now beginning to develop the conservative line of work. It is not easy to state the indications for the radical operation, since they are only in the process of being defined.

One point should be emphasized—when the disease is bilateral every effort should be made to do conservative work on one side, at least. In non-purulent salpingitis resection will probably to a considerable extent replace removal of the tube. When the tube is greatly thickened, crumpled, and deeply buried in adhesions, its complete removal is probably the most satisfactory procedure. If there is evidence of recent infection or of suppuration, resection should not be performed. In cases of hydrosalpinx, where very marked distention exists, removal should be carried out, if possible, rather than resection. When partial distention is present resection should be more often employed, though removal is best if there be any evidence that the tubal contents are not sterile.

In some cases, owing to the dense adhesions between the tubes and impor-

tant structures, salpingectomy may be a prolonged and difficult operation; there may be much bleeding from separated adhesions; wounds of viscera may be made; extensive raw surfaces may be left, and infective pus may escape. Sometimes, when the patient's general condition is not satisfactory, attempts at removal may lead to unwise prolongation of the operation, and it may be necessary to desist from removal. In such a case the abdomen should be closed and the fluid collection should, if possible, be incised and drained through the vagina.

Many operators advise removal of the uterus along with the tubes in certain instances (see Chapter XVII). This is to be recommended especially in cases where no portions of the tubes or ovaries may be conserved, where the uterus is badly infected, and where it has been extensively adherent, so that after freeing it much of its surface is raw and oozing.

It must be remembered that occasionally the uterus may be used for plastic purposes after the diseased parts have been removed. Freund has made it serve to cover a rent in the anterior rectal wall. Webster has made use of the organ in a case in which old pus tubes were dissected out of the pelvis, leaving a very large raw surface. The ovarian and uterine arteries were ligated and the uterus was cut away by a coronal section close to its anterior peritoneal surface. The broad ligaments with the intermediate uterine flaps were turned downward and stitched to peritoneum around the posterior and lateral pelvic walls, the raw space below being first stuffed with gauze and carried into the vagina. In this way a clean peritoneal floor was formed in the pelvis.

Hematosalpinx.—*Etiology.*—The tube may become distended with blood as a result of atresia in the uterus or vagina. It is thought by many to be a reflux from the uterus of menstrual blood; but against this view is the fact that often the inner end of the tube is closed. In some cases it is due mainly to hemorrhage from the tubal mucosa. The nearer the atresia to the tube, the more quickly is the hematosalpinx formed. In hymeneal atresia, according to Bandl, the condition is rarely observed. Sometimes only one tube is affected; when both are distended it is usually to an unequal extent. Hematosalpinx may develop in connection with the rudimentary horn of a malformed uterus, or with a bicornate uterus where atresia exists on one side. Another important cause of the condition is tubal gestation. It may also develop in connection with acute infectious diseases. Sometimes it occurs with large pelvic tumors, *e. g.*, myoma uteri. It has been noted after local traumatism, *e. g.*, pelvic massage. It may originate in a hemorrhagic form of salpingitis.

Pathology.—As the tube distends its wall gets thinned, although it may be thickened in parts by inflammation which may give rise to adhesions. The blood remains fluid for a long time, probably owing to its mixture with the tubal secretion, becoming dirty brown in color. Rupture of the sac may sometimes occur. Rarely gangrene of the wall or suppuration of the contents may take place. Torsion of the broad ligament below the distended tube may sometimes occur. When tubal pregnancy is the cause, the ovum may be completely broken up and diffused throughout

the blood, or it may be partly or entirely detached, becoming incorporated with the blood mass to form a "mole." The amount of blood poured out varies in these cases; often the mass tends to increase owing to fresh hemorrhages following the first loss. In the early stages the ovum looks like a fresh blood-clot, and unless the specimen be studied with care, the various tissues of the ovum may not be recognized.

Later the mass becomes pale and firm, undergoing the ordinary changes of blood-clot; shrinkage tends to take place, in many cases, very slowly. It is important to note that in a certain number of these cases, where the clinical evidence points strongly to ectopic pregnancy, the most thorough examination of the tubal contents may fail to reveal corroborative evidence.

Diagnosis.—There is nothing distinctive in the symptoms of hematosalpinx; they are usually associated with others due to the condition causing the trouble. The distended tube causes no symptoms in some cases; in others there may be distress or pain in the affected side; the latter may be constant or intermittent, and probably depends mainly upon the associated peritonitis. Pressure symptoms relating to bladder, rectum, and other structures are often present. Physical examination gives the same result as in the case of chronic hydrosalpinx or of pyosalpinx.

Indications for Salpingectomy.—Until recently removal of the tube has been carried out in all degrees of hematosalpinx. This is not necessary save in extreme distention of the tube and in cases where an infective process is active; in other cases resection is best, by which method a patent portion is left.

Tuberculosis of the Tubes.—The Fallopian tubes, according to Whitridge Williams, are the most frequent seat of genital tuberculosis. It is generally associated with similar disease in the uterus, ovaries, or peritoneum. Tubal tuberculosis is usually secondary to the disease elsewhere, although, as a rule, primary as regards the genitals. Very rarely is it primary as regards the whole body.

Pathology.—The disease is found as the miliary, chronic diffuse, and chronic fibroid forms. The appearances presented by the tube are varied. In marked cases it is enlarged, the outer end being usually occluded; tubercles are seen on the surface, and adhesions are present. The lumen contains yellow caseous matter, sometimes thick, sometimes partly calcified. In old cases the inner surface is irregular, ragged, and studded with tubercles, while the wall is more or less hypertrophied by inflammation. The tube may become considerably distended and displaced. In slighter cases the tubercles may be scanty and the tubal enlargement not very great. The disease is often most marked in the infundibular end. Sometimes there is a single nodular enlargement, due to the massing together of several tubercles.

Diagnosis.—There is no means by which the disease can be definitely diagnosed. The symptoms may be simply those of local pelvic inflammation or of chronic tuberculosis, but the local symptoms may be masked by those due to tuberculosis in other parts.

Indications and Contraindications to Operation.—When the tube alone is affected it should be removed, even though nodules be found on the peritoneum

elsewhere. This procedure is inadvisable when advanced pulmonary tuberculosis exists, but may be carried out if the lung affection be in an early stage. If the ovaries are affected they should be removed with the tubes. Where there is bilateral disease the uterus with the appendages should be extirpated.

Tumors of the Tubes.—These are rare. The entire tube should be removed when the swelling is large or malignant. In the cases of small benign tumors resection of the tube may be performed.

THE OPERATION.

Salpingectomy may be carried out by both the abdominal and vaginal routes. The latter is rarely as favorable as the former because it does not permit of thorough



FIG. 310.—REMOVAL OF DISEASED FALLOPIAN TUBE—SALPINGECTOMY.

a, Forceps holding edge of infundibulopelvic ligament; b, denuded area from which the tube has been removed; c, uterus; d, continuous catgut suture used to approximate the edges of the divided peritoneum.

examination of the pelvis, and because manipulations are more difficult. When there are extensive adhesions, when the tube is high in the pelvis or greatly distended, when there is a suspicion of appendicitis or when tuberculosis is present, the vaginal route should not be chosen. A small vagina is a contraindication to its selection.

By Abdominal Section.—On opening the abdomen in the middle line the relationships of the pelvic contents should first be carefully studied. If slight omental adhesions exist they should be separated by the fingers; if very firm or extensive, ligatures should be applied and the omentum divided between them. Intestinal adhesions should be most carefully divided; sometimes the bowel wall must be dissected away with a knife. The pelvis should be next explored. If only slight adhesions exist around the tube they may readily be broken with the fingers and the broad ligament with the tube raised toward the abdominal incision.

When adhesions are extensive or firm they should be divided under observation;

otherwise there is risk of injuring important structures, *e. g.*, bowel. In such a case the abdominal incision should be enlarged as much as is necessary and free intestine should be pushed upward from the pelvis, sterilized gauze pads being introduced to prevent them from descending. The Trendelenburg posture is of great assistance in carrying out these manipulations.

The adhesions are separated with the fingers or are rubbed off with a piece of gauze. If they are long they should be tied in two places with catgut and divided. If they are short and very firm it may be necessary to dissect them from the tube with knife or scissors. When the tube is greatly distended it may be possible to remove the mass without bursting it. Generally, in such cases, it is best to aspirate the contents and to close the opening with a suture or with forceps before proceeding with its removal.

When both tubes are diseased and fixed by adhesions it is best to carry out separation of the latter on both sides previous to removal. This is safer than to take away the mass on one side before freeing that on the other, because when the latter method is adopted there is always danger of loosening the first applied ligatures by the manipulations necessary to break down the adhesions on the opposite side.

When the tube is completely freed from adhesions it is raised up into the incision, gauze sponges being packed into the pelvis to check the oozing of the blood from the denuded surfaces. Removal of the tube is then carried out. The outer part of the mesosalpinx is held by forceps. The tube is then cut away from the broad ligament along its whole length. Bleeding may be temporarily checked with forceps. A portion of the uterine end of the tube is removed by a small V-shaped incision into the uterine tissue. In an infective case the rest of the tube lumen should be cauterized. By removing the inner end in this manner one can insure such satisfactory closure of the raw surface as to prevent any after-establishment of communication between the remains of the tube and the peritoneal cavity. The old method of ligating the inner end of the tube may be followed by this result, which may set up fresh pelvic infection. Bleeding points in the bed of the tube are then tied with catgut and a continuous catgut suture is applied along the upper margin of the ligament so as to completely cover the raw surface with peritoneum. (The remaining stages of the technic are described on page 629.)

SALPINGO-OÖPHORECTOMY.

(a) **In Fibromyoma Uteri.**—Ever since Lawson Tait introduced the operation of removal of the appendages in the treatment of uterine fibroids it has been very widely employed. Within recent years it has been largely abandoned in America and in many European countries as a result of the marvelous reduction of mortality attendant upon abdominal and vaginal hysterectomy. The operation is mostly in favor in Great Britain. It is difficult, at the present time, to state with precision its proper sphere of employment. This is a matter which will be settled within a few years by widening experience. My own opinion is that salpingo-oöpho-

rectomy is very rarely necessary, and should be carried out only when it is the particular desire of the patient, or when, owing to the condition of the patient or the nature of the tumor, hysterectomy is likely to be attended with fatal results. Unfortunately, in those conditions which increase the risk of the latter operation—large size of tumor, impaction in the pelvis, extensive adhesions, extensive extra-peritoneal development—it is not often possible to carry out removal of the appendages on account of their inaccessibility, so that the major procedure may be the only course open to the surgeon if operation be desired.

The effect of salpingo-oöphorectomy is no doubt very satisfactory in many cases and is followed by some shrinkage of the tumor and improvement in the symptoms, but recovery is not as rapid as after a successful hysterectomy. In some cases only partial benefit is gained, while occasionally no improvement follows.

With regard to hysterectomy, apart from complete removal of the tumor and speedy recovery, there is the satisfaction that one or both ovaries may often be left to exert their normal influence on the organism.

The Operation.—Before attempting removal of the appendages a careful examination must be made to determine whether both can be satisfactorily taken away. Sometimes they may be easily reached on one side, but may be inaccessible on the other. Occasionally an ovary may be so thinned and stretched over the tumor as to be unrecognizable; it may be buried between two parts of the growth or in adhesions. It is useless to do the operation on one side unless it can be satisfactorily carried out on the other. It is performed as described on page 625. It is important that no raw stump should be left in order that intestinal adhesions may not form. In passing ligatures there is great risk of piercing veins in the broad ligament, as they are usually much enlarged in these cases. Sometimes troublesome hemorrhage results and may be difficult to control. After removing the appendages on one side there is great risk of loosening the ligatures by the manipulations necessary to reach those on the other side. It is therefore a good rule to remove, first of all, those most difficult of access. There can be no doubt that the removal of the ovaries is the essential factor in bringing about improvement in these cases. The tubes are unimportant and their removal does not appear to influence metabolic processes. In general it may be said there is no reason for removing them. Double oöphorectomy should rather be the aim. If the tubes are diseased, or if their extirpation can better facilitate removal of the ovaries, they should also be taken away. If the smallest portion of an ovary be left, improvement in the patient's condition need not be expected, although in some cases there is no benefit even when all the ovarian tissue has been removed.

(b) **In Inflammatory Conditions of the Tubes and Ovaries.**—The pathology, etiology, symptoms, and physical signs of salpingitis and ovaritis have been considered. As regards the performance of salpingo-oöphorectomy for these troubles, it has already been pointed out that as a result of conservative ideas the present tendency is toward its less frequent employment. Hitherto it has been the routine custom in removing the tube to take away the ovary also, no matter what its con-

dition, and *vice versa*, in removing the ovary to take away the tube. Such a procedure must now be regarded as unjustifiable.

It is not easy to lay down exact indications for the combined operation. Generally speaking, it may be stated that it should be carried out only when both ovary and tube are so badly diseased as to exclude the hope of performing conservative operations upon them. These conditions have already been referred to (pages 616 and 621), and are also considered in the sections dealing with "conservative" operations on the uterine appendages.

(c) **Tubo-ovarian Cyst.**—This condition, called by Bland Sutton "ovarian hydrocele," is rare. It consists of a sac containing thin fluid situated on the posterior layer of the broad ligament, the fimbriated end of the Fallopian tube communicating with the sac. The tube is usually elongated and dilated. When the cyst is small the ovary projects from the inner wall of the sac; when it is large it is spread out and blended with the sac wall, being sometimes unrecognizable as a distinct structure. The fluid may discharge from time to time through the tube and uterus; sometimes it may become purulent.

According to Bland Sutton, the condition arises from the distention of a fold of peritoneum which occasionally surrounds the ovary—the so-called "ovarian sac." This sac normally exists as a covering to the ovary in several mammals—the rat, hyena, mare, guinea-pig; in others—baboon and porcupine—the sac is only partly formed. Ovarian hydrocele is sometimes found in these animals.

The Operation.—Removal of the appendages is generally best carried out as follows:

(a) *By Abdominal Section.*—The abdominal incision is made as already described. The tube and ovary are carefully detached from adhesions in the manner detailed on page 625. Various methods are employed in removing the appendages and in preventing bleeding.

1. The tube and ovary being raised to the abdominal incision, a strong catgut ligature is tied around the outer part of the broad ligament securing the ovarian vessels. Another is firmly applied to the upper part of the broad ligament close to the uterus and below the tube; it includes the utero-ovarian ligament. The ovary is then cut from its attachment at the hilum and the raw surface carefully sutured with continuous catgut and covered with peritoneum. The Fallopian tube is then dissected from its bed and removed as described under "salpingectomy." A series of catgut sutures are then applied to the raw surface in such a manner as to check bleeding and to cover it with peritoneum. When the tube and ovary are adherent they may be together cut from the broad ligament, the single raw surface thus produced being closed by the continuous catgut suture. The advantage of operating in this manner is that raw surfaces are completely covered and the broad ligament is not left in a state of tension.

2. A favorite method with some operators is to secure a pedicle *en masse*. The appendages are raised and the broad ligament pierced below the ovary with a pedicle needle carrying a strong double ligature, care being taken to avoid injuring vessels.

The needle is then withdrawn. The ligature may be secured by means of the Staffordshire knot. The loop is thrown over the mass to be removed until it rests on the free ends of the ligature. One of these is then drawn through this loop so as to lie on it. Both ends are pulled tightly so as to constrict the pedicle. They are

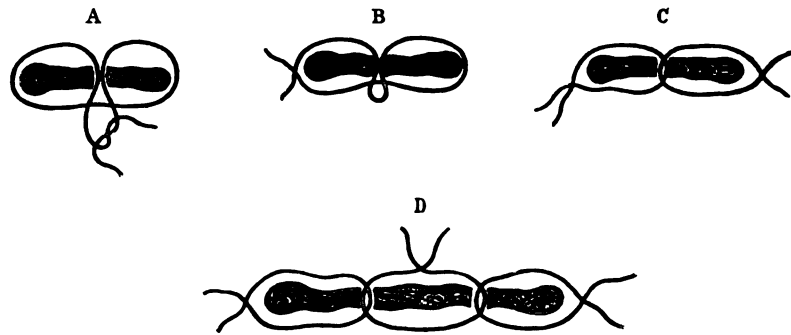


FIG. 311.—VARIOUS FORMS OF LIGATURE *en masse*.

A, Staffordshire or Lawson Tait knot; B, Bantock knot; C, Double interlacing ligatures; D, Triple interlacing ligatures.

then tied by the ordinary surgical knot. The Bantock knot is preferred by some. When the needle is withdrawn, one of the free ends is carried around the pedicle, passed through the loop and tied to the other free end on the opposite side of the pedicle.



FIG. 312.—REMOVAL OF DISEASED APPENDAGES—SALPINGO-OÖPHORECTOMY.

a, Pyosalpinx; b, ligature applied to ovarian vessels in infundibulopelvic ligament; c, ligature applied to utero-ovarian ligament and upper part of broad ligament under the tube.

After the knot is tied, a pair of forceps is applied to each side of the pedicle, about 1 cm. ($\frac{2}{5}$ in.) outside the ligature. An assistant then holds the absorbent pad under the forceps and keeps the intestine and abdominal walls aside while the pedicle, consisting of infundibulopelvic, broad and utero-ovarian ligaments, and tube, is

divided external to the forceps. The stump is then carefully sponged. If there be no bleeding, the ends of the ligature are cut away, the forceps removed, and the stump allowed to sink into the pelvis. If after cutting the tube and ovary there be bleeding, or if the operator be in doubt as to the security of the ligature, another ligature should be tied around the pedicle under the forceps.

By this method a certain amount of tension is left in the broad ligament owing to the bunching together of the tissues. This is most marked when the tissues are thick, when the ligament is naturally tense or made so by the presence of inflammatory bands. Another objectionable feature is that a raw stump is left behind which may become adherent to the intestine; moreover, the uterine end of the tube may sometimes become patent. If this procedure be adopted, an effort should be made to bury the stump in peritoneum.



FIG. 313.—REMOVAL OF DISEASED APPENDAGES—SALPINGO-OOPHORECTOMY.

a, Extent of denuded area after removal of appendages; b, infundibulopelvic ligament with ligature applied; c, upper part of broad ligament and utero-ovarian ligament with ligature applied; d, continuous catgut suture approximating the edges of the divided peritoneum.

3. Others prefer to secure the pedicle by interlacing ligatures which extend from the infundibulopelvic ligament to the uterus below the level of the tube and ovary. They may be passed by means of a pedicle needle or with an ordinary needle carried in a holder. The objection to this method is that when the tube and ovary are cut away a considerable area of raw surface is left, and this may give rise to adhesions. The stump should therefore be covered with peritoneum.

Complications Attending the Removal of Diseased Tubes and Ovaries.—

When in the course of removing diseased appendages many adhesions are separated, more or less oozing of blood is apt to follow. It has already been stated that as the surfaces are denuded, gauze pads should be firmly packed against them. This usually suffices to check bleeding. If after the diseased parts are removed there is still some oozing when the pads are taken from the pelvic cavity, a careful search

should be made for the bleeding points. Sometimes another firm gauze pack may be successful in stopping the flow.

It may be necessary to ligate certain points by means of a needle and catgut suture, or the application of the cautery may be tried. Thorough irrigation of the pelvis with hot normal saline solution will often check oozing; if it does not completely cease, 400 c.c. or more of the fluid may be left in the abdomen when it is closed. The blood that continues to escape mixes with the salt solution and becomes absorbed into the system. In cases where the bleeding is marked many operators carry out drainage. Such a course is unnecessary save where the bowel has been injured or an infective process is in progress. Drainage should always be carried out through an incision made between the pouch of Douglas and the posterior fornix of the vagina, unless some contraindication exists, in which case the abdominal incision should be used.

If in removing a tube or an ovary containing pus the sac should burst, allowing the fluid to escape, the latter should be at once removed by gauze pads, which should be put aside and not used again. If there is a suspicion that the fluid is not sterile, Webster recommends washing out the pelvis at such a junction with saline solution containing formaldehyd (1 : 2000).¹ He has shown that this antiseptic can in such a strength be safely used in the peritoneal cavity.

Fortunately, in most cases the pus is so old as to be sterile, so that its escape is not a serious matter. It is, however, impossible to be certain as to its state during an operation and it is safer to avoid the risk of contamination of the peritoneum.

Drainage after Abdominal Section and Operation upon the Pelvic Organs.—In the early period of abdominal surgery drainage was very frequently employed for the following purposes:

1. To withdraw septic material from the peritoneal cavity in infected cases.
2. To withdraw non-septic fluids, *c. g.*, blood, serum, cyst-contents, etc.
3. To determine the occurrence of secondary hemorrhage.

In recent years drainage has been much less practised and, at the present time, it is comparatively rarely employed by experienced operators. This change is due to the knowledge which has been gained regarding the peritoneum and the bacteriology of infectious diseases, to greater care exercised in selecting the period of operation, and to improvements in technic.

Formerly, for example, it was customary to open the abdomen to remove diseased tubes and ovaries in all stages of infection. Now it is considered that this operation in the acute stage is unjustifiable unless general peritonitis is developing. It is preferable to wait for a later period until the toxicity of the infected areas is so reduced that contamination of the healthy peritoneum, which may be brought about during removal, may not produce fresh infection. The dangers following operations in acute cases caused the older operators to resort to drainage in all

¹ Webster, J. C.: "Infective Peritonitis with Special Reference to a Suggested Method of Improving the Present Methods of Surgical Treatment," Amer. Gynecol. Jour., Nov., 1899, vol. xiii, p. 429.

cases in which purulent matter escaped during removal. It is now understood that such measures are unnecessary in cases in which infections of some duration are present, since the pus is usually sterile, indicated by the subsidence of marked febrile phenomena and by absence of leukocytosis.

In the acute stage of infection accumulations of pus which can be reached by vaginal incision should be evacuated, and, at a later period, abdominal removal of the diseased tissues carried out if necessary to the restoration of health.

At the present time it is not considered necessary to drain for the purpose of removing blood and serum, except in the presence of very infective material. Great care is taken to insure as thorough hemostasis as possible before the abdomen is closed. Denuded areas, from which serous oozing may take place, are covered, and the peritoneum handled as carefully as possible. With regard to blood and serum, it is well known that absorption may occur before coagulation occurs; that after this change, removal is brought about by the action of leukocytes; that while uninjured peritoneum absorbs most actively, injured peritoneum may also perform this function; that fresh blood and serum are germicidal and may be able to destroy many organisms.

Sterile foreign material, *e. g.*, cyst contents, may to a large extent be removed from the peritoneal cavity by thorough irrigation with normal saline solution and by gentle sponging. That which cannot be taken away in this manner is gradually carried off by the peritoneum, the fluid being everywhere absorbed, solid particles being disintegrated and removed through the diaphragmatic peritoneum by means of leukocytes.

Formerly drainage was carried out in most cases of intestinal, vesical, and ureteral injuries. Modern methods of repairing these are so perfected that the drain is rarely necessary as a precautionary measure.

When portions of infected tissues cannot be entirely removed (a rare occurrence), drainage is advisable if there is not absolute certainty that they are sterile. Frequently, however, such tissues may be destroyed by the cautery.

Objections to Drainage.—That drainage is not a harmless procedure is evident from many clinical and experimental observations. It may cause constipation, tympanites, nausea and vomiting, owing to interference of the drain with the intestines. Fecal fistula may be caused. Sometimes the inflammatory reaction around the drain may cause vesical disturbances, *e. g.*, irritability, dysuria, cystitis; sometimes resulting suppuration may form a fistulous opening. Cases in which drainage is employed are more liable to be followed by hernia than those in which it is not used. Infection is apt to enter the drainage tract from without.

Clark¹ made a study of 100 cases of abdominal section in which extensive adhesions had been separated and drainage employed, and also of 100 similar cases in which no drainage was carried out. In the latter series suppuration occurred only once, and in the former eight times.

¹ Clark, John G.: "A Critical Review of Seventeen Hundred Cases of Abdominal Section from the Standpoint of Intraperitoneal Drainage," *Amer. Jour. Obstet.*, 1897, vol. xxxv, No. 4, p. 481.

Substitutes for Drainage.—At the present time it is considered that attention to the following points necessarily implies the infrequent use of drainage:

1. Strict attention to asepsis.

2. Perfection of technic. The operation should be performed carefully, but without unnecessary waste of time. The general peritoneal cavity should be walled off from the field of operation by sterile gauze pads moistened in hot normal saline solution. The peritoneum should not be exposed to dry, cold, or dusty air. It should not be roughly handled. Denuded areas should be covered with peritoneum as much as possible. Septic tissue and fluid should be removed as carefully as possible, so as not to contaminate healthy areas.

Within recent years irrigation of the peritoneal cavity and retention in it of normal saline solution at a temperature somewhat higher than that of the normal body have been widely employed, to great advantage in cases where shock is likely to follow, *e. g.*, prolongation of operation, loss of blood, etc. It is also used to wash out escaped debris, cyst contents, or other foreign material. This procedure is of great value. It is a powerful stimulant, supplies heat to the body and fluid to the vessels, and increases renal activity. In cases in which oozing of blood from denuded areas is likely to continue after closure of the abdomen, the saline solution diffuses the blood and prevents local clotting. J. G. Clark¹ has been foremost in advocating the retention of 500 c.c. or more of the fluid, in cases in which the presence of septic material is suspected. This should be associated with elevation of the lower end of the patient's bed, because in this position foreign particles more quickly reach the diaphragm, through which they are chiefly carried (Muscatello²). The saline solution serves somewhat to disintegrate and dilute the toxic material, and this enables the leukocytes to act more advantageously.³ This postural drainage is only to be used as a prophylactic against post-operative infection, and not when general peritonitis is established. In purulent peritonitis it is of no value, because, as Pawlowsky has demonstrated, the lymphatics leading from the peritoneum are blocked with microbes and inflammatory products. Free drainage through incisions is better in this condition. Where ascites is present, it is not advisable to use saline solution for retention, Waterhouse having shown that absorption from the peritoneal cavity is very imperfect where that condition exists. Neither is it advisable in cases in which large quantities of fibrin or thick cyst contents have been disseminated in the cavity for several hours.

In a recent paper Clark and Norris⁴ have published an account of observations and experiments which support strongly the earlier views of the former.

¹ Clark, John G.: "Postural Method of Draining the Peritoneal Cavity after Abdominal Operations," Johns Hopkins Hosp. Bul., April, 1897, No. 73, p. 59.

² Muscatello, G.: "Ueber den Bau u. das Aufsaugungsvermögen des Peritonäum," Virchow's Archiv, 1895, Bd. cxliii, S. 327.

³ Waterhouse, H. J.: "Experimentelle Untersuchungen über Peritonitis," Virchow's Archiv, 1890, Bd. cxix, S. 342.

⁴ Clark, John G., and Norris, Charles C.: "A Practical Application in Abdominal Surgery of Scientific Investigations on the Function, Anatomy, and Pathology of the Peritoneum," Jour. Am. Med. Assoc., Aug. 10, 1901, p. 360; *ibid.*, "Peritoneal Saline Infusions in Abdominal Operations," Jour. Am. Med. Assoc., Jan. 30, 1904, p. 281.

In experimenting as to the fate of minute sterile granules of India ink and carmin placed in the peritoneal cavity, they found that these were carried through the diaphragm into the retroperitoneal lymph-channels, being widely distributed. Within eight hours they were found in the marrow of long bones, liver, kidneys, lungs, etc.

On injecting infectious microorganisms or irritants into the cavity, there is an increased flow of lymph and leukocytes into the cavity, varying according to the degree of irritation. This is followed by their passage into the general circulation. The omentum plays an important part in providing for the supply of serum and leukocytes, its vessels being numerous and thin-walled. The examination of the blood after abdominal operations reveals increased leukocytosis. Though this may be partly due to the anesthetic, it is also due to the traumatism of the operation. C. Y. White has found that the post-operative leukocytosis averages somewhat over 20,000.

When drainage is used the leukocytosis persists longer. When normal saline solution is placed in the cavity, the average leukocytosis is higher during the first twenty-four or thirty-six hours. In cases in which infective material is present, the salt solution, therefore, exercises an additional beneficial influence by causing a greater number of the cells to enter the peritoneal cavity and attack the microorganisms.

Clark and Norris have made a very interesting series of experiments in inoculating the peritoneum with virulent cultures of organisms, followed by the introduction of normal saline solution, and have shown that the latter undoubtedly minimizes the risk of infection. All control animals in which no salt solution was used died, whereas of the test animals in which it was used, 44 per cent. were saved, and the duration of life in those which died was longer than in the control animals which died.

Methods of Drainage.—Drainage may be carried out through the abdominal wall, through the vagina, or by both of these routes. The indications for selecting these are given in connection with the various operative procedures described in this work.

Vaginal drainage is obtained by establishing a communication between the pouch of Douglas and the posterior fornix. (Before all abdominal operations for pelvic disease, the vagina should be thoroughly cleansed in case this form of drainage may be necessary.) The end of a strip of sterile antiseptic gauze¹ is passed into the vagina, the remainder being packed in the pouch of Douglas. In two or three days it may be removed through the vagina and another portion

¹ The writer strongly recommends chinisol gauze, made as follows: Prepared strips are dipped in the following solution:

Chinisol powder.....	1 part
Glycerin.....	2 parts
Sterile water.....	20 "

These are hung up to dry, arranged in rolls, covered with cotton, and sterilized in the steam chamber. Chinisol is strongly inhibitory to microorganismal activity, and in this strength has no toxic effects.

inserted, if considered necessary. Some operators use a T-shaped rubber tube instead of the gauze.

Vaginal drainage has the great advantage over drainage through the anterior abdominal wall that it does not predispose to the development of hernia. The vaginal route should be selected unless there is a special reason for abdominal drainage.

Abdominal drainage is carried out by the following means:

Glass or rubber tube alone.

Glass or rubber tube filled with gauze.

Glass or rubber tube surrounded with gauze.

Gauze alone.

Each of these methods has its advocates and there are differences of opinion as to their relative merits.

The chief objections to the glass tubes are as follows: a permanent sinus may be established; a fecal fistula may be formed by pressure of the tube on the bowel; intestinal obstruction may occur from the traction of adhesions formed around the tube; the omentum (sometimes the intestine) may work into the lumen through the lateral apertures and become strangulated. The tube may sometimes be broken.

The objections to gauze drainage are as follows: The gauze leads to free oozing of serum, which may become infected; its meshes become saturated and its capillary action soon lessened. Free discharge of fluid is thereby retarded and it may burrow beyond the drainage area.

Too early removal of gauze may cause considerable disturbance, because of interference with the adhesions which have formed around it. These may be ruptured, hemorrhage may be set up, a ligature may be separated, and omentum or bowel may be dragged out. Severe pain may also be produced. As the fibrous layer surrounding the gauze organizes, it becomes less firmly attached to the latter; after the fifth day removal becomes more easy. It is also important to note that in taking away the gauze, organisms which may have entered its outer portion may be squeezed into the peritoneal cavity and thus cause infection. Gauze may, however, be saturated with an antiseptic, *e. g.*, chinol, which is an advantage in draining an infected cavity; the risk of infection from without is also diminished.

Rubber tubing has the advantage over glass that it cannot be broken and cannot injuriously press on viscera. It may, however, become bent or constricted so that drainage is interfered with; if it is perforated with lateral holes, the omentum or bowel may be herniated through the latter.

In the majority of cases, perhaps, in which abdominal drainage is carried out anteriorly, the glass tube is satisfactory. In cases in which there is marked oozing from a large denuded area, or in which it is desired to wall off an infected area from the general peritoneal cavity, it is introduced with strips of gauze, which are packed around it, their free ends projecting through the abdominal incision.

The tube may be straight or curved, and should reach the lowest part of the cavity to be drained. It may project through the lower end, or some other part of the incision. In closing the latter, it is best to suture the peritoneum independently, except where the drain lies. The remaining abdominal tissues of the abdominal wall are then approximated, the skin-opening through which the tube passes being left somewhat larger than the tube. The dressings are best applied as follows: several layers of antiseptic gauze are placed over the incision. This is covered with a square piece of rubber sheeting, in which a perforation is made for the tube; this prevents the dressing next the incision being soaked with the discharges. Over the mouth of the tube is placed a sterile pad, and the whole area is covered with absorbent cotton fastened in position with strips of adhesive plaster and a bandage, care being taken that there shall be no pressure over the end of the tube.

During the first twenty-four hours or more the dressings may require to be changed more than once, owing to the escape of discharges. It may also be necessary to evacuate the drainage-tube by means of a rubber tube attached to a syringe. If, however, a strip of gauze is kept in the tube, there may be a constant capillary flow outward into the dressings. The strip of gauze may be renewed from time to time. When blood-clot forms in the tube it must be sucked out with a syringe. In carrying out these manipulations the most thorough precautions as to asepsis must be observed.

The tube may be needed only a few hours or one or more days. The longer it remains in position, the greater the risk of infection from without, the longer the period of healing, and the greater the risk of peritonitis afterward. In the great majority of cases the tube may be withdrawn in twenty-four to forty-eight hours. When it is taken out, the edges of the incision may be allowed to approximate if there is no infection in the case. If the drainage has been carried out on account of the latter condition, a strip of antiseptic gauze may be inserted into the hole and changed during the succeeding days. When the drainage tract is deep, a rubber tube may be employed, being gradually shortened. When the dressings are changed, the hole may be irrigated with hydrogen peroxid and an antiseptic solution, *e. g.*, formalin 1 : 1000.

In cases in which the incision becomes infected, it is advisable to apply moist dressings, the gauze being soaked with a solution of formalin, 1 : 1000, or some other antiseptic.

When the intestine has been injured, gas or fecal matter may pass from the tube. Indeed, this may be the first intimation that the accident has taken place. In some cases air escapes, having entered the peritoneal cavity during the operation, or having been sucked in during spells of vomiting.

To prevent the entrance of omentum or bowel into the perforations of the tube, the latter should be rotated and moved slightly up and down when the dressings are changed. If the tube should become fixed by the formation of herniæ, rotation may lead to their withdrawal. Sometimes, however, it is necessary to withdraw the tube in order to remove them.

The use of extensive gauze packing is very rarely necessary. Indeed, the writer only employs it in opening the abdomen in cases of ectopic gestation where, after removing the fetus, it is deemed advisable to leave the placenta *in situ* for several days. A series of strips of chinosol gauze tied together serve the purpose. Mikulicz's plan of using a gauze bag filled with independent strips has largely been abandoned, as it is complicated. Iodoform gauze should not be used in these cases, because of the risk to the patient from absorption of the drug.

(b) **By Vaginal Section.**—The appendages may be removed by this route in some instances. Indeed, it is preferred by many operators if the conditions are favorable to easy manipulations. The peritoneum is best opened by the uterovesical pouch through the anterior fornix. The tube and ovary are then removed by one or the other of the two methods above described. When the vagina is narrow or exceptionally long, or the bony outlet contracted, when abundant or dense adhesions exist in the pelvis, it is best to select the abdominal route in order that the field of operative procedure may be more satisfactorily exposed and denuded areas carefully covered with peritoneum.

CHAPTER XVII.

ABDOMINAL HYSTERECTOMY FOR INFLAMMATION OF THE UTERINE APPENDAGES.

BY J. M. BALDY, M.D.

Like the development of all operations, that of abdominal hysterectomy for pelvic inflammation was the outcome of much thought and study of the general plans of treatment in use in old times, particularly as to their results. It was, as so often happens, the outcome of several minds working independently along the same lines at the same time with an almost simultaneous announcement of practically the same conclusions and results.

During the last months of 1891 my own first operation of the kind for this condition was performed. This operation and the subsequent ones were allowed to accumulate until October 5, 1893, when they numbered six cases and were reported in a formal paper,¹ my experience at this time being such as to warrant my urging the adoption of the procedure as a routine operation. The same month (October, 1893), and almost the same day, William M. Polk,² of New York, presented a paper on the same subject, giving similar conclusions and urging a like procedure. In this paper Polk refers to his first case, operated on early in the year 1892 and reported in February of the same year. His experience had, from this first case up to the time of his paper, increased by the number of seven patients so treated.

The great epoch of abdominal hysterectomy for inflammation of the uterine appendages was October, 1893, when Polk and Baldy, having each given two years' independent study to the subject and having come after much the same experience to about the same conclusions, gave to the surgical world (Polk through the medium of the New York Obstetrical Society, October 3, 1893, Baldy through the medium of the Philadelphia Obstetrical Society, October 5, 1893) their experience and placed the operation on a sure and permanent basis.

As is the rule in any great advance in this world, the presentation of these two papers at almost the same time, the one in New York, the other in Philadelphia, provoked an almost universal storm of opposition and criticism. The two exceptions to this opposition were Florian Krug, of New York, and Harris A. Slocum, of Philadelphia. Slocum, in discussing Baldy's papers, advised the

¹Baldy, J. M.: "Removal of the Uterus and its Appendages for Pelvic Inflammatory Disease," *Annals of Gynec.*, Nov., 1893, vol. vii, p. 57. "Extirpation of the Adnexa," *Am. Jour. of Obstet.*, vol. xxx, No. 1, 1894. "Hysterectomy for Suppurative Disease of the Pelvic Organs," *Am. Gyn. and Obstet. Jour.*, Sept., 1895, p. 221.

²Polk, W. M.: "Hysterectomy (Suprapubic) for Salpingitis and Ovaritis," *N. Y. Jour. Gyn. and Obstet.*, Dec., 1893, vol. iii, p. 1053.

adoption of the procedure and called attention to the fact that he had written a paper on the subject which would shortly be published and which subsequently (October 7, 1893) appeared in the "Medical News."¹ In this paper Slocum recommends the adoption of the treatment, although it appears that he himself had never performed the operation. Krug² in the discussion of Polk's paper strongly supported the author and stated that he (Krug) had first performed the operation a year before and a number of times subsequently with most satisfactory results. With these exceptions the opposition was universal; in most instances strenuous, in a few half-hearted. Even George M. Edebohls,³ who discussed Polk's paper, gave less than a half-hearted support—a support so cautious as to amount to a practical opposition; although he stated that two weeks after Polk's first reported case he had presented to the New York Obstetrical Society the uterus and its appendages from a case of pyosalpinx which he (Edebohls) had removed during life, and that he had subsequently performed three similar operations. Within the year much of the opposition had ceased, and within two years the majority of gynecologic surgeons had adopted the operation in suitable cases as a permanently established procedure. Thereafter the only discussions on the subject from authoritative sources were as to the relative value of the complete or incomplete abdominal hysterectomy and as to the relative value of the abdominal *versus* the vaginal operation.

As operators performed and still perform the total hysterectomy for other diseases, so they adopted this detail in their cases of pelvic inflammation; as operators preferred and still prefer the amputation method of performing hysterectomy (excepting in the presence of tuberculosis or malignancy), so they preferred this method for the inflammatory cases. And so both classes still choose. This is a mere matter of detail and is of no particular importance, the results in one case being as good as in the other; it is simply a matter of personal preference and habit, with the less risk, if there be any, on the side of the amputation method.

The question of the abdominal *versus* the vaginal route for performing these operations was long and exhaustively discussed on both sides of the Atlantic Ocean; in the main, Europe, led by the French, standing for the vaginal, America for the abdominal method. The battle is finished. America has largely (almost universally) increased her loyalty to the abdominal method, Europe (even the French) having been largely converted to the abdominal method as the better one in the majority of cases.

Pelvic inflammation, with exceptional tubercular cases, is caused by either gonorrhea or post-puerperal septicemia. All other supposed causes are dependent on these two. The infection in any given case may be mixed in character.

The disease originates as a vulvitis, vaginitis, or cervicitis, eventually extending

¹Slocum, H. A.: "A Problem in Abdominal Surgery, Why is the Uterus Retained after the Ovaries are Removed?" Medical News, 1893, vol. lxiii, p. 400.

²Krug, Florian: Discussion on "Removal of the Uterus in Disease of the Uterine Appendages," N. Y. Jour. Gyn. and Obstet., 1893, vol. iii, p. 1093.

³Edebohls, G. M.: "Remarks upon the Removal of the Uterus in Diseases of the Appendages," Transac. N. Y. Obstet. Soc., Nov. 7, 1893, p. 74.

to become endometritis in the case of gonorrheal infection. In the case of a septicemic infection it begins as endometritis. The disease then follows one of two courses.

The rare course and one only followed by post-puerperal cases is for the inflammation to extend through the uterine walls by way of the veins and lymphatics into the connective tissue of the broad ligaments. Such cases result in enormous inflammatory deposits in any and all connective tissues about the uterus, which at times break down into abscesses. These cases, whether they break down or not, are best treated by a vaginal incision, deep penetration with the finger into the masses, and drainage.

The usual course for the extension of the endometritis, if the attack is virulent enough to extend at all, is into and through the Fallopian tubes. The infection having attacked the mucous membrane of the Fallopian tube, either one of two things occur: Lymph is rapidly thrown out from the serous membrane of the fimbriæ and the tube becomes closed, or the inflammation travels so rapidly as to escape into the pelvic cavity through the still patulous fimbriated end of the tube. In the first case a pyosalpinx, hydrosalpinx, or hematosalpinx results, usually with the Fallopian tube and ovary adherent to everything with which they come in contact. In the second case, if the patient does not die of a general peritonitis, pus forms in the true pelvis and becomes localized by the overlying omentum and intestines becoming adherent.

The condition of the uterine, ovarian, and tubal tissues after the virulence of the primary attack has worn itself out is variable in degree. The uterine mucous membrane may be in a condition of chronic inflammation, the uterine walls infiltrated more or less with inflammatory deposits or pus pockets; the Fallopian tubes (closed at both uterine and fimbriated ends) distended with pus, serum, or blood and their walls thickened with inflammatory deposits or pus pockets, the ovaries enlarged and containing pus, the broad ligaments and the pelvic connective tissue thickened and containing pus deposits, all or any of the pelvic contents matted together by adhesions.

Symptoms.—The symptoms of the patients vary according to the degree of the lesion. They suffer from pelvic, abdominal, and back pains which are aggravated by motion. A feeling of fullness and weight or bearing down is frequent. Constipation renders their condition more intolerable. Coitus, driving, or walking is painful. Menstruation is irregular—usually too frequent and too profuse. Leukorrheal discharges appear or become mucopurulent and more profuse if they existed before. Reflex nervous and gastric symptoms of all kinds become common. The patient finally drifts into a state of chronic invalidism—either too ill to leave home or she haunts the doctor's office seeking relief from her almost constant suffering. If pus exists an accelerated pulse and elevated temperature may add to her miseries and a slow chronic septicemia with all its attendant evils becomes a considerable element in her suffering. At infrequent intervals she is liable to more or less severe attacks of acute pelvic inflammation, from which she has a prolonged convalescence and in which she may even lose her life.

General Considerations.—In determining for or against extirpation of the uterus in pelvic inflammatory disease, certain general considerations will arise.

1. *Is the uterus essential or useful after the ovaries have been removed?* The uterus has one use in the body, namely, that of containing and developing the human embryo. In the face of the loss of both ovaries, it is evident that the necessity for the uterus has departed, and together with the necessity its usefulness. The peculiarities which go to make up the womanhood of the woman rest solely in the ovaries and not in the womb. Nor is it a demonstrable fact that this organ has anything whatever to do with the integrity or support of the vaginal vault. If any support obtains to the vagina from above it is from the broad, vesical, and sacral ligaments, but their integrity is destroyed to exactly the same extent by double ovariectomy as by hysterectomy. If there be any truth in the argument that the cervix is the keystone to the vagina, there is no necessity for the removal of this structure in this class of cases; the uterus may be extirpated by an amputation so low down as to be practically a complete removal and yet leave the vaginal portion of the cervix intact. Thus, the relation of the vagina and cervix remains unchanged and the pelvic floor with its attachments is relieved of the weight imposed upon them by a useless and possibly diseased uterus. There is undoubtedly less sagging of the pelvic floor when the uterus has been removed than when a double ovariectomy has been performed.

2. *Are all patients cured after an operation requiring double ovariectomy?* This proposition is answered in the negative by a common and universal experience. Pryor states that a large number of the patients from whom he had removed both adnexa containing pus, leaving the uterus behind, regret ever having undergone the operation. The surgeon should either preserve the menstrual function by conservative measures or else in doubtful cases remove the uterus when the ovaries and tubes are taken away for purulent disease. Such patients, if the uterus is left, not infrequently suffer for many months or years with pain, metrorrhagia, and mucopurulent leukorrhea. In marked contrast to these cases are the convalescence and future comfort of those cases of myomata with pus tubes in which the uterus has been ablated. It is well known that in pelvic inflammation the disease first affects the womb and secondarily invades the Fallopian tubes and the pelvic peritoneum. Not only is the endometrium affected, but the inflammatory products invade the deeper structures which go to make up the uterine walls. If a suppurative process follows, these infiltrates undergo the same changes as do the same elements in the walls of the Fallopian tubes. This is clearly demonstrated by the ease with which a ligature cuts through the uterine tissue when applied at the cornua in cases of pus tubes. With a Fallopian tube and uterus both diseased by the same factor and to the same extent it is not rational to suppose that a cure is to be always obtained by the removal of the tubes alone. As Polk has indicated in studying the results of this disease upon the uterus, it should be understood that with the disappearance of the acute stage the uterus is often displaced in one direction by the pressure of the masses of exudation, and later displaced in the opposite direction by the contraction of the same exudation, now diminished in bulk and organized. The uterus

may be retroverted and bound down, attached to the rectum, and in the cul-de-sac. It may be thrown into a position of anteversion or of lateral version by shortening of both or one of the uterosacral ligaments. Another common displacement is the lateral one, dependent upon shortening of the broad ligaments, the fundus being the portion chiefly affected if the contraction be along the upper border; the cervix if it be along the base. The condition of the structure of the organ is apt to be decidedly abnormal if with these displacements the tubes are in a state of chronic inflammation. The body is enlarged and sensitive and from the cervix a purulent or mucopurulent discharge escapes.

It must not be understood from the foregoing that removal of the uterus is recommended in all cases of pelvic inflammatory disease. In very many cases the uterus has succeeded in throwing off the original infection, is comparatively healthy, and no contraction of the ligaments has taken place. Under such circumstances it would not be necessary to remove the uterus. Again, it is not necessary to remove the uterus in those cases of purulent destruction of both adnexa in which atrophy of the genitalia has already begun. Such a condition is not infrequently seen in old prostitutes.

3. *Are patients cured after hysterectomy, where double ovariectomy has failed?* Experience alone can provide this answer. In a paper read before the Philadelphia Obstetrical Society, Baldy reported two cases in which the uterus had been removed subsequent to a simple extirpation of the appendages. After the primary operation these patients had continued to suffer from leukorrheal discharges, hemorrhage, and pain. The secondary operations for removal of the uteri proved that the appendages had been thoroughly extirpated at the first operations and that no such cause as incomplete removal existed to account for the continued suffering. The removal of the uterus in both cases cured the patients and both remain permanently in good health. Similar operations have been performed since that time in many instances with like results. It is claimed by those opposed to the radical operations that proper intrauterine treatment will result in a cure without the necessity of removing the womb. Under the most skilful and conscientious application of these palliative methods of treatment, both by the author and many able gynecologists, absolute failures have been recorded in many cases. The first patient upon whom the author performed hysterectomy in pursuance of this plan had been submitted to the primary operation of double ovariectomy a year or more previously, and the second operation was performed only after thorough trial of the methods of intrauterine medication had been made.

4. *Does the operation of hysterectomy increase the mortality above that of double ovariectomy?* Personally, not only has hysterectomy in the hands of the author lessened the mortality very materially, but it has also rendered the convalescence infinitely smoother, easier, and more satisfactory! A total of 223 cases in the hands of Baldy, Kelly, Polk, Krug, Pryor, and Penrose, with but six deaths, gives a mortality of but 2.68 per cent., a much better showing than has been made by the same operators where they confined themselves to double ovariectomy.

5. *Is the retention of the uterus of any disadvantage or danger to the patient?* Not infrequently the womb bleeds and gives rise to mucopurulent discharges indefinitely after removal of the appendages. This may in a few cases result from incomplete removal of appendages, but such a result cannot obtain where the more radical operation is performed. The mere fact that removal of the uterus will cure these symptoms is an unanswerable argument in favor of hysterectomy in these cases. Not only are the objectionable symptoms removed, but also the danger of subsequent prolapse of the heavy and diseased organ.

It is contended that about 20 per cent. of all cases of pus tubes are tubercular in origin, and this can only be decided by a careful microscopic examination of the specimen after removal and not always by their macroscopic appearance at the time of the operation. Each and every form of local tuberculosis is a menace to the health of the patient, and whenever such a focus exists its removal is indicated. Hence, as tubal disease is frequently secondary to disease of the uterine mucosa the latter at times is tubercular also and should be removed. Then again the elimination of any fear of future malignancy in the uterus is by no means a small consideration. The infection which originally caused the pelvic involvement, even though not tubercular in nature, came through the uterus and may persist in the uterus after pus tubes and ovaries are removed and may recur in the uterus from fresh exposure; hence an additional advantage in removing the organ. Finally, the removal of pus cavities communicating with the bowel gives a large mortality where the uterus is retained; in this group of patients the mortality greatly lessens when the uterus is removed with the appendages.

Indications for the Operation.—The foregoing questions having been settled satisfactorily, it necessarily follows that hysterectomy is the operation of choice over double ovariectomy in a certain percentage of the class of cases under consideration. It remains to determine in what cases to choose this operation.

Hysterectomy should be the operation of choice:

1. Where an abdominal section is performed for the removal of the uterine appendages and the womb is found greatly enlarged, infiltrated, and diseased, especially if it has been surrounded by extensive adhesions and the freeing of it leaves large areas of denuded peritoneum which may be the cause of readhesion of the uterus or an amount of oozing which will necessitate the use of a drainage-tube.

2. Where one or more abdominal sections have been performed upon a woman, and relief has not followed.

3. Even where the uterus is not greatly diseased, if during the course of the operation for removal of the appendages it be largely denuded of its peritoneal covering.

4. Where there is extensive purulent involvement of the broad ligament, hysterectomy affords an avenue for perfect drainage.

5. When there is any good reason for believing that this organ will in future become the seat of the disease.

6. Where the removal of the uterus will facilitate an operation or give greater security against hemorrhage.

7. In all cases in which, even though one appendage be perfect in all particulars, the tubercle bacilli have been found in the scrapings from the uterus previously obtained for diagnostic purposes.

9. When the uterus itself is diseased, the diseased condition not admitting of removal by curetage of the uterus.

10. When there is an inability to distinguish the boundary-line between the uterus and the adnexa, the genitalia interna forming a conglomerate mass impossible of resolution into its component parts.

In all cases it is, of course, assumed that both ovaries must of necessity be sacrificed with the exceptions above noted. Except in the presence of malignant or tubercular disease the womb should never be disturbed if even a portion of one ovary and a Fallopian tube can with safety be preserved. Nor is an operation to be extended to the performance of hysterectomy when a double ovariectomy will even temporarily answer the purpose, should the patient be in such a condition that the prolonged manipulation might render the result in a given case doubtful.

Why the Abdominal Method of Operating is Preferable.—In America, with rare exceptions, the abdominal method has been the one of choice over the vaginal route and to be preferred for the following reasons:

1. That all the parts may be exposed to the eye as well as to the touch, and hence greater accuracy and security can be obtained.

2. The parts may be thoroughly inspected before any organ has been removed or destroyed, in order to determine whether or not the Fallopian tubes and ovaries must be sacrificed.

3. All intestinal or bladder injuries may be readily discovered and corrected.

4. Any damage to the vermiform appendix may be detected and corrected.

5. The adnexa may with certainty in all cases when necessary be completely removed together with the womb.

6. All the wounds may be closed, denuded surfaces mostly covered over with peritoneum, and drainage avoided in the vast majority of cases.

7. The operation is easier to perform and hence can be accomplished with lessened risk to the patient by the greater number of surgeons.

The short convalescence claimed for the vaginal method does not in reality obtain. It is true that most of these patients are sent home in two weeks after their operation, but as a matter of fact the foul discharges from their wounds continue for several weeks longer. Most patients who require such a severe operation as hysterectomy are physically in such a condition as to make a prolonged stay in bed together with careful nursing and feeding a great consideration. As a rule, therefore, the sending of a patient home in two weeks, rather than a benefit, is a positive detriment to her future health. Many of these cases would be the better for it were they to remain in bed six weeks or longer.

The claim that by the vaginal method the peritoneal cavity is not opened is

untrue save in a very few instances. It is extremely rare to meet with a case in which both uterus and appendages are absolutely buried beneath a wall of adhesions. At some point the uterus or the uterine appendages are in relation with the general peritoneal cavity; therefore, whether the vaginal or abdominal hysterectomy be performed the barrier is broken down and the general peritoneal cavity entered.

The only possible condition in which vaginal hysterectomy may be preferable is in those cases in which there is a large pelvic abscess (but no pyosalpinx or ovarian abscess), accompanied by dense and extensive intestinal adhesions which it would be impossible or highly dangerous to the intestines to separate. In this class might also be included those rare cases of pyosalpinx and ovarian abscesses of enormous size in which there is oftentimes a doubt as to just where the pus is confined and in which there is a bulging into the vagina.

TECHNIC OF THE OPERATION.

The Operation Itself.—The preparation of the patient for the operation is that which is carried out in every abdominal section, be it for any disease whatever, the condition aimed at being surgical cleanliness and the complete emptying of the whole gastro-intestinal canal. (See chapter on Preparation.) Ordinarily it is sufficient to begin the preparation twenty-four hours before the operation. Occasionally patients are so badly run down from long suffering that it is well to keep them in bed under a careful stimulating and dietetic treatment for a week prior to the operation. This is rarely necessary.

After opening the abdomen in the usual manner, the patient being in the Trendelenburg position, the intestines are rolled back toward the diaphragm and carefully covered over with successive layers of gauze pads so placed as to exclude any and all discharges from the pelvis from entering or soiling the general abdominal cavity. This procedure also insures a good and uninterrupted view of the whole pelvis throughout the operation.

All adhesions are now (no adhesion being broken until the general cavity is fully protected by gauze packing) broken up wherever they are found to exist, so that the uterus, Fallopian tubes, ovaries, broad ligaments, and the hollow viscera are all free from any attachment to each other at any point. It is important that this be fully accomplished before the next step of the operation is proceeded with.

The Fallopian tube and ovary on one side are now grasped by the hand of the operator and drawn up out of the abdominal incision (or as much so as possible). Frequently the thickening and consequent shortening of the broad ligament is so great from inflammatory infiltration that it is impossible to elevate the ovary and Fallopian tube to any great extent. The organs being drawn well toward the uterus, the broad ligament between its Fallopian tube attachment and the pelvic wall is exposed. At this exposed point the ovarian artery is ligated by passing a ligature through the broad ligament. It is desirable, when possible, to pass this ligature so low in the broad ligament as to pass under the round ligament, thus

including this ligament together with its blood-vessels in the same pedicle as is the ovarian artery. The object of this mass ligature is that the remnant of the broad ligament when the operation is complete be as short as possible, and consequently give better subsequent support to the vaginal vault than if the broad ligament be left from a half inch to an inch longer (leaving the vaginal vault so much more chance to prolapse).

The cornu of the uterus is now grasped and a ligature passed through the broad ligament directly under the point of entrance of the Fallopian tube and round ligament into the uterus. This ligature temporarily controls hemorrhage from the uterine side after the ovarian artery is cut.

The ovary and Fallopian tube are now drawn once more toward the uterus, exposing the ligature on the broad ligament near the pelvic wall, and with a pair of scissors the broad ligament is cut through from the ligature diagonally across the broad ligament (severing the round ligament) to a point on the uterine neck at or near the internal os. As the incision approaches the uterus at this point the uterine vessels (veins and artery) will be seen running up the side of the organ, closely hugging it. Care is taken not to cut these vessels at this time. The opposite broad ligament is treated in precisely the same manner. The uterus being dragged well up, the point of the scissors is now slipped under the peritoneum (the anterior flap) of either broad ligament and an incision made around the anterior surface of the uterine neck at the junction of the uterus and bladder until the incision joins its fellow of the opposite broad ligament. The finger rapidly pushes the bladder away from its loose attachment to the uterus.

A ligature is passed (first on one side and then the other), under the uterine artery (which can be easily felt pulsating) at the point where it approaches the uterus to run up its side. If the ligature is made to hug the uterine tissues closely there is absolutely no danger of including the ureter. The uterus is amputated at a point close above the ligature. The amputation is cone-shaped in order that the anterior and posterior surfaces of the remaining stump may the more readily be brought together by a subsequent suture.

Up to this point all the suture material has been of silk as small as is compatible with safe tying. Many operators use catgut for these ligatures, and no objection can be found to this practice. The material makes no difference; its cleanliness and its proper adjustment are everything.

The cervical canal is now cleansed with a piece of cotton wet with a bichlorid of mercury solution and the anterior and posterior edges of the stump whipped together with a continuous catgut suture. The edges of the peritoneum on the anterior and posterior surfaces of the broad ligament are whipped together in the same manner from side to side of the pelvis, beginning at the stump of the ovarian artery on one side and stopping only at the similar stump on the opposite side. This procedure buries the stumps of the uterine artery as well as the stump of the cervix behind the peritoneum and makes pressure on all raw and bleeding surfaces. The peritoneal edges are drawn together by the continuous suture tense enough so that

the pressure will be sufficient to insure a cessation of all oozing of blood. The abdominal cavity is closed in the usual manner.

Atypical Cases.—The operation may be varied in several essentials in special cases. Occasional cases occur in which the inflammatory lesions are so great as to make it extremely difficult (almost if not quite impossible) to separate the tubal and ovarian masses or the uterus from the surrounding viscera without extreme danger of damage, some of which may be irreparable. This is especially true of the left side, where at times the point of beginning of the sigmoid flexure of the large bowel and that of the tubal and ovarian mass are indistinguishable. Under these circumstances



FIG. 314.—BISECTION OF UTERUS—FIRST STEP.

Fundus exposed and both cornua grasped. The black line indicates the line of section.

the enucleation is better made from below than from above. This is accomplished by ligating the ovarian artery in the usual manner on the side which is the most easily manipulated. When the uterine artery is exposed on this side it is at once ligated and the uterus amputated at the neck. In making the amputation, as the distal side of the cervix is approached by the scissors or knife, the uterus is drawn forcibly toward that side and away from the side on which the cutting is being done in order to keep the incision well open and in full view. Immediately when the last fiber of the uterine tissue is severed the uterine artery comes into view running upward in the loose connective tissue close to the cervix. The artery and veins are grasped

by a pair of forceps and incised, and with the fingers the enucleation on that side of the pelvis is continued by dragging upward and outward the uterus, together with the whole mass. As the ovarian artery comes into view it is grasped by the forceps and the mass cut away. The forceps are now replaced by ligatures and the operation proceeded with as before. In this manner operations may be completed with comparative ease and safety which by the usual method would be exceedingly difficult and dangerous. This operation has points of disadvantage over the ordi-

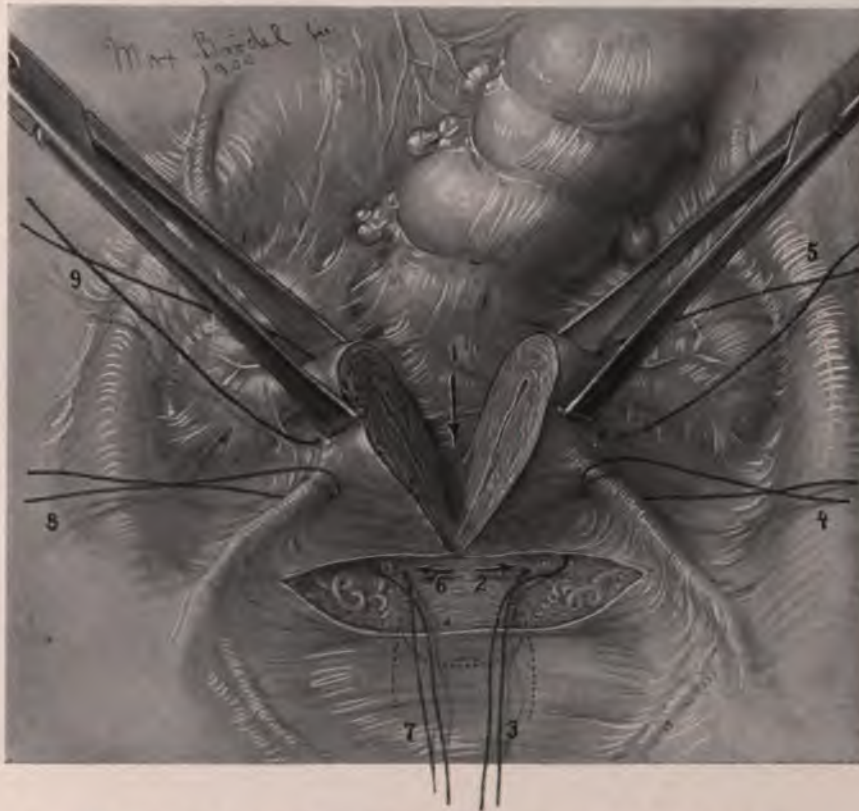


FIG. 315.—THE FUNDUS BISECTED DOWN INTO CERVIX. THE BLADDER DETACHED.

The steps are: 1, Division of fundus from above downward as indicated by arrow; 2, amputation of left half of cervix, exposing uterine vessels on that side; 3, control of these vessels; 4, ligature of left round ligament; 5, ligation of left uterine cornu; 6, 7, 8, 9, similar steps on right side.

nary one (such as greater danger to the ureters) which renders it advisable only to use it in the cases designated and not as a routine operation. The ordinary operation is by far the safer and is as easily and quickly performed.

Some surgeons prefer to perform a complete hysterectomy in these cases in preference to the amputation method. The removal of the cervix with the fundus uteri has no advantages whatever to offer, and has several disadvantages. The total operation involves a much more difficult manipulation, a prolonged operation, a

wider area of denuded surfaces, and more hemorrhage with a consequent greater chance of shock. The operation may be performed in either of two ways: ligate the vessels successively, first on one side then on the other, and open the vagina anteriorly and posteriorly; or ligate the vessels on the side most easily manipulated, open the vagina on that side, and after dragging the uterus forcibly to the opposite side ligate the opposite set of vessels from below upward, as proposed by Pryor.

Bisection of the Uterus.—For certain difficult cases with marked adhesions, much exudate, and collections of pus Kelly¹ has devised a technic involving the

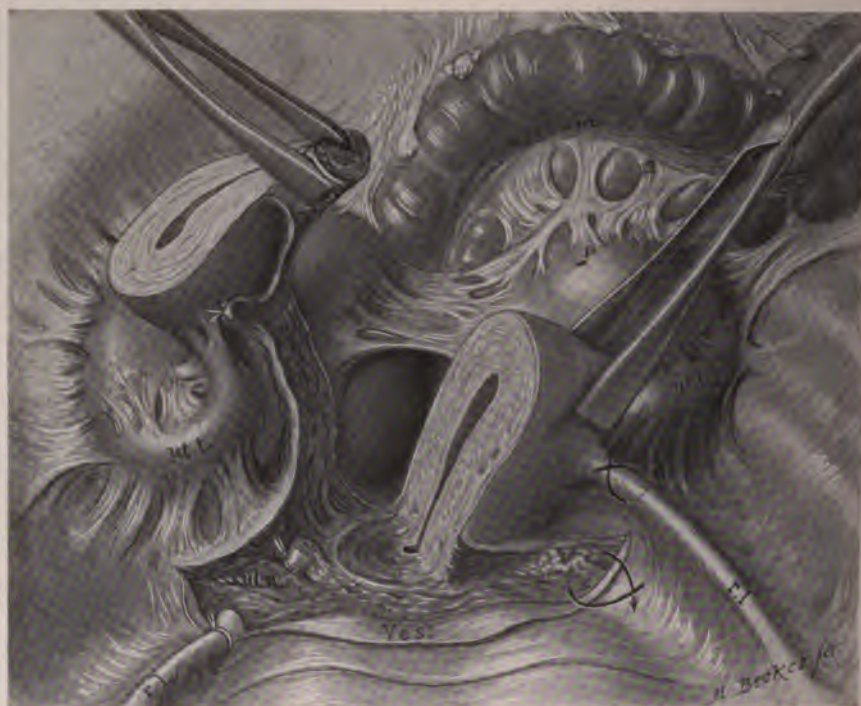


FIG. 316.—THE UTERUS BISECTED. THE RIGHT HALF INVERTED AND ATTACHED ONLY BY ITS CORNU.

bisection of the uterus and the removal of each half before removing the tubo-ovarian masses.

The steps are these: If the uterus is buried out of view, the bladder is first separated from the rectum and the fundus found; then, if there are any large abscesses, adherent cysts, or hematomata, they are evacuated by aspiration or by puncture; the rest of the abdominal cavity is then well packed off from the pelvis.

The right and left cornua uteri are each seized by a pair of stout museau forceps and lifted up; the uterus is now incised in the median line in an antero-posterior direction, and as the uterus is bisected its cornua are pulled up and

¹ Kelly, H. A.: "The Removal of Pelvic Inflammatory Masses by the Abdominal Bisection of the Uterus," *Am. Jour. Obstet.*, 1900, vol. xlii, p. 818.

drawn apart. With a third pair of forceps the uterus is grasped on one side on its cut surface, as far down in the angle as possible, including both anterior and posterior walls. The museau forceps of the same side is then released and used for grasping the corresponding point on the opposite cut surface, when the remaining museau forceps is removed. In this way two forceps are in constant use at the lowest point. I commonly apply them three or four times in all. As the uterus is pulled up and the halves become everted and it is bisected further down into the cervix, if the operator prefers to do a panhysterectomy the bisection is carried all the way down into the vagina. The uterine canal must be followed in

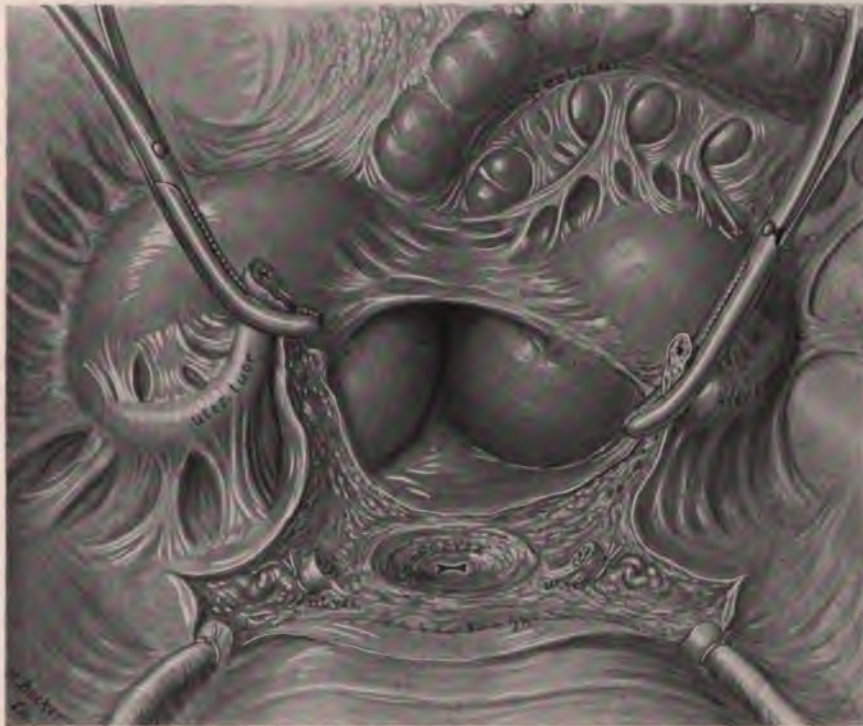


FIG. 317.—THE PELVIS WITH THE UTERUS REMOVED, LEAVING THE ADHERENT TUBES AND OVARIES TO BE ENUCLEATED AFTERWARD.

the bisection, if necessary using a grooved director to keep it in view. The museau forceps are now made to grasp the uterus well down in the cervical portion, if it is to be a supravaginal amputation, and the cervix is bisected on one side. As soon as it is divided and the uterine and vaginal ends begin to pull apart, the under surface of the uterine end is caught with a pair of forceps and pulled up, and the uterine vessels, which can now be plainly seen, are clamped or tied. As the uterus is pulled still further up, the round ligament is exposed and clamped, then finally a clamp is applied between the cornu of the bisected uterus and the tubö-ovarian mass, and one half of the uterus is removed. The opposite half of the uterus is also taken away in the same manner.

The pelvis now contains nothing but rectum and bladder, with right and left tubo-ovarian masses plastered to the sides of the pelvis and the broad ligaments, affording abundant room for investigation of their attachments, as well as for deliberate and skilful dissection; the wide exposure of the cellular area over the inferior median and anterior surfaces of the masses offers the best possible avenue for beginning their detachment and enucleation.

The operator will sometimes find, on completing the bisection of the uterus, that he can just as well take out each tube and ovary together with its corresponding half of the uterus, reserving for the still more difficult cases, or for a most difficult side, the separate enucleation of the tube and ovary after removal of the uterus.

The **after-treatment** is that of any abdominal section.

The **prognosis** of hysterectomy for these diseases in the worse class of cases is better than that of double ovariectomy and salpingectomy in similar cases, principally for the reason that all diseased foci are reached and removed with certainty, and all raw and bleeding surfaces are done away with or covered over with peritoneum, drainage being therefore unnecessary. Up to 1895, 223 cases operated on by this method by Kelly, Polk, Krug, Pryor, Penrose, and Baldy, gave 6 deaths, a mortality of 2.68 per cent. What better results could be asked?

CHAPTER XVIII.

VAGINAL DRAINAGE FOR PELVIC ABSCESES.

BY HOWARD A. KELLY, M.D.

History.—The history of the treatment of pelvic abscess is fraught with the deepest interest, for it exhibits in miniature all the phases of the history of the growth of gynecology at large. It has its genesis in the timid conservatism of thirty years ago, and then stepping out of swaddling clothes it advances through the phases of the most radical methods in abdominal surgery, to terminate in a sound conservatism allied to a bold radicalism, applied in properly selected cases.

The older method of treating pelvic abscess was based on false pathology, giving rise to the conception that there was a suppurative process going on in the cellular tissues of the broad ligament; the natural course then was to be extremely conservative, there was nothing to do but to wait, and so the function of the surgeon was confined to watching for the abscess to ripen and present a marked area of fluctuation at the vaginal vault, when he ventured, not without anxiety, to incise and to drain it "per vias naturales." This was the surgery of Sims, and of Emmet in his earlier years. This was the day when "pelvic cellulitis" dominated the pathology of the lower abdomen.

The next step was that taken by Lawson Tait, who boldly opened the abdomen, insisting that the abscess was invariably to be found encapsulated in either the uterine tubes or in the ovaries, which ought to be extirpated. Where Tait could not shell the abscess out, he recommended suturing the abdominal wall to the convex surface of the abscess and then draining it, in this fashion, extraperitoneally—a hazardous alternative.

Tait's methods were too radical for the stomachs of his older contemporaries, but a still more extreme radical form of treatment of pelvic abscess was destined to have a trial and find warm advocates, namely, that of Péan and his school of enthusiastic followers, particularly Segond. This new method consisted in the vaginal extirpation of the entire uterus, by a vaginal bisection or by morcellation. By means of such a skilful hysterectomy through the vagina, the abscess cavities situated posteriorly and at the sides were easily opened, after which they collapsed, and abundant drainage was secured by a dependent avenue, a rapid recovery being the result.

This exsective method of operating upon pelvic abscesses was criticized with special severity by the late M. Säger, who considered that its field of utility should be limited to those cases in which an abdominal operation was impossible, or to cases complicated by fistulæ.

In France the old simple method of evacuation of pelvic abscess by the

vagina followed by drainage was advocated under a new form—namely, earlier diagnosis and more prompt treatment—by Laroyenne, Vulliet, and Jullien, who objected to severe radical procedures and were able to cite brilliant results under this praiseworthy conservative course.

In this country I have myself consistently and almost from the first resorted to the evacuation of such pelvic abscesses as could be felt through the vaginal vault, followed by free drainage. This operation has also found warm advocates in Cabot,¹ Noble,² and others.

Pelvic abscesses are among the most serious, the most dangerous, and the most important conditions with which the gynecologist has to contend. The abscess is not in itself the disease, but constitutes the end-product or the final outcome of an infection which, as a rule, is first located in the uterus and then in the uterine tube. The disease is therefore an infectious salpingitis which runs its course and results in the thickening of the walls of the tube, with an infiltration of inflammatory products in such a manner that the abscess, instead of draining, becomes shut in and retained in the pelvis.

Etiology and Pathology.—Salpingitis is not the only source of a pelvic abscess, although it is by far the commonest. Abscesses may also arise either from the direct penetration of organisms through the tissues into the surrounding cellular structures, or from the direct invasion of the cellular structures in case of trauma, as so frequently takes place after birth. We may thus have an abscess:

1. In the uterine wall.
2. In the uterine tube.
3. In the ovary.
4. In the peritoneum.
5. In the subperitoneal connective tissue.
6. A variety of abscesses in other parts of the pelvis, in the neighborhood of the rectum, the vagina, or the bladder.

With the last class of abscesses we are not concerned here. The first class—abscesses in the uterine wall—are very rare indeed, apart from acute puerperal processes. It is my purpose to speak now of groups 2, 3, 4, and 5. The fifth group, or puerperal abscesses, will be dealt with briefly after considering those which are found in the uterine tubes and the ovaries.

In the fourth group are found those accumulations of pus in the pelvis which are not contained in any organ and are localized by the agglutination of all the contiguous structures. These abscesses are observed in cases in which the pus has escaped from the uterine tube and been walled off in the manner described. They are also not infrequently found in cases of extrauterine pregnancy in which the blood, poured out into the pelvis, has become infected, converting the mass into a pelvic abscess (suppurating hematocele). This group does not require any special consideration in its treatment.

¹ Cabot, A. T.: "Treatment of Pelvic Abscess," *Ann. Gyn. and Ped.*, 1892, vol. v, p. 540.

² Noble, C. P.: "Treatment of Suppuration in Uterine Appendages," *Amer. Med.*, 1902, iii., p. 507.

A variety of microorganisms may be concerned in bringing this condition to pass. The commonest are the familiar pus-producing organisms and the gonococcus.

As long as the abscess is retained in the body, the patient's health suffers and life itself is threatened. Cases are not rare in which accumulations of pus, for some time shut off, and for the time innocuous, have, spontaneously or under exertions or from mechanical violence, ruptured into the peritoneal cavity, setting up a virulent peritonitis with a fatal result.

The formation of the pelvic abscess, walled off either by the walls of the uterine tubes or by intestinal adhesions, constitutes in many instances nature's best efforts to dispose of a dangerous guest.

Other ways of disposing of abscesses are:

By absorption.

By rupture into a neighboring viscus, rectum, vagina, bladder, or abdominal cavity.

By discharging through the uterus.

I do not desire to speak here of the small accumulations of pus found in the broad ligaments in puerperal infection, where there is great edema and thickening of the broad ligaments with small suppurative foci. The encysted pelvic abscesses with whose treatment we are now dealing vary in their location, in size, and in position.

The location of the abscess is, as a rule, in the distended ampullar portion of one or both uterine tubes. Sometimes the pus which has escaped from a tube gravitates down between the uterosacral folds, and forms an abscess in Douglas' cul-de-sac which may be completely shut off from the cavity above by the adhesion of the uterosacral ligaments, the rectum, and the uterus above. An abscess may also be walled off by agglutinated small intestines, but this is rare.

The size of the abscess may vary from a small one, not amounting to more than a few drops or a teaspoonful of pus, all the way to a great accumulation which fills the pelvis, or if it is connected with the vermiform appendix, rides up over the brim of the pelvis into the iliac fossa, in bad cases even extending over the left brim into the fossa of that side. The large abscesses are often single,—that is to say, a single opening on the pelvic floor serves to evacuate all the pus. Two or three encysted accumulations of pus are so often found that when the vagina is opened for drainage

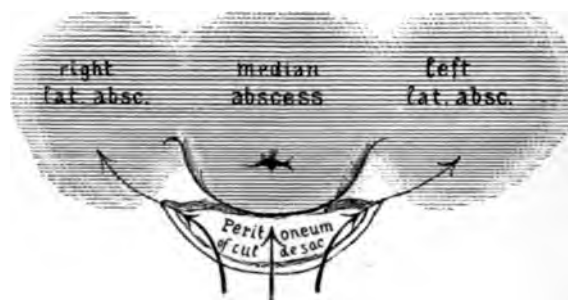


FIG. 318.—THE LOCATIONS OF ABSCESSSES UPON THE PELVIC FLOOR.

On the right side behind the broad ligament; on the left side behind the broad ligament; in the median line behind the uterus, usually below the uterosacral folds. Below the cervix is shown the method of approaching the right and left abscesses by incising the vaginal wall, and then pushing to the right or to the left in opening an abscess without opening the peritoneum. (Hunner's method.)

it is one of the rules of the operation to make use of the incision as an avenue by which to introduce one or two fingers well up into the pelvis behind the uterus, and with the aid of the outside hand make an investigation on the right and on the left side for the purpose of discovering any subsidiary abscesses which have not been tapped by the first incision. The rule holds good that the operator must assume the presence of two or three abscesses until the contrary is proved by this careful bimanual palpation under anesthesia.

The position of the abscess in the pelvis is of the utmost importance in determining whether it will be wiser to treat the case by the vaginal route or from above. An abscess may be median or it may be lateral, estimating as median those abscesses which can be felt either bulging into or lying in juxtaposition to the vaginal vault behind the cervix. Lateral abscesses are those which lie well over the one side and can only be felt by corresponding displacement of the vaginal vault. In treating a median abscess there is no risk whatever of going into the peritoneal cavity; while in attempting to reach a lateral one, the peritoneum is almost sure to be opened, unless some special precautions are taken.

Treatment by Vaginal Incision and Drainage.—This form of treatment is by far the best for these serious cases—far better than the most ideal abdominal section—for the reason that abundant experience has shown that the most aggravated cases may make a perfect recovery after so simple an operation as incision and drainage by the vagina. Many cases are recorded, and I have witnessed some within my own experience, in which the woman so treated has not only recovered her health, but has even gone through a normal pregnancy subsequent to the operation. On the other hand, if the abdomen is opened it is impossible to drain these structures satisfactorily in the direction of the abdominal incision, and conservatism is but awkwardly applicable and not without danger. The operator by the abdominal route will in almost all instances be compelled to sacrifice both uterine tubes, and he will in very many instances do a most radical operation, extirpating uterus, tubes, and ovaries, where a simple vaginal drain would have saved all of these important structures, preserving the functions at least of the uterus and ovaries, and in many instances of one or both tubes. For all of these important reasons the vaginal route is *par excellence* the method of treatment of pelvic abscess in all cases in which a satisfactory diagnosis can be made and in which the pus can be reached by that avenue.

The results of the treatment of intraperitoneal abscesses about the uterus by evacuation and drainage through the vagina have been carefully studied by Noble.¹ Noble here contrasts a mortality of 27 per cent. by the abdominal route with less than 2 per cent. mortality in the patients treated by vaginal incision and drainage.

The advantages of the vaginal drainage operation over the radical abdominal operation are the following:

1. A greatly diminished mortality.
2. Preservation of structures.

¹ *Loc. cit.*

3. Restoration in many instances to normal condition, including menstruation and pregnancy.
4. Avoidance of complications, such as injury to adherent intestines.
5. A much easier convalescence with less suffering.
6. No risk of post-operative hernia.
7. Feasibility when the patient is too ill to survive an abdominal operation.

The ideal operation, then, is one which succeeds in opening, evacuating, and draining the abscess without opening the peritoneal cavity.

Occasionally, in spite of the utmost precaution, the operator will find, upon introducing his finger to investigate and break up the secondary abscesses, that the finger is in direct contact with the uterus, the intestines, and the pelvic walls, in the free open peritoneal cavity. Under these circumstances it is necessary to remove all pus and cleanse the abscess with unusual care, and to fill the lower pelvis with a loose gauze drain.

Operation by the vaginal route and the treatment of the abscess by evacuation and drainage instead of by a more radical abdominal operation, are in reality following in the footsteps of our predecessors, but acting with greater skill and precision and anticipating the later stages of the disease by exposing and draining the abscess long before it has gone so far as to point by an area of softening either in the direction of the vagina or the rectum.

The good old rule for centuries has been "*ubi pus ibi evacua*," laying stress on the *ibi*, as pointing out the best place to evacuate the pus—at the nearest and most depending point.

Before every operation the surgeon should make a minute investigation, preferably on two occasions, assuring himself as to size and position of the abscess.

If there is doubt as to whether there is any pus it is a safe procedure to cleanse the vaginal vault and then cautiously introduce a hypodermic needle or a needle of little caliber, into the sac and aspirate, in order to make sure that there is pus present.

After thoroughly cleansing the vagina and exposing the field of operation, the posterior lip of the cervix is caught with a tenaculum forceps and held forward while the vaginal vault is cut through with the red point of the cautery knife from side to side, as though one were about to make an opening into Douglas' cul-de-sac. The opening thus made should be about an inch in breadth. As the peritoneum or



FIG. 319.—THE POSTERIOR VAGINAL WALL INCISED, EXPOSING THE PERITONEUM, WHICH IS NOW OPENED.

This is done in the case of a median abscess, or of an abscess which is high up and cannot be reached on the right or on the left, without injury to the peritoneum.

adherent abscess is opened the pus gushes out. The wound is made as wide above as the vaginal opening and the abscess allowed to drain off. It is sometimes well to wash out a large abscess under gentle pressure, but this is always associated with some risk of throwing fluid up into the abdomen and so distributing the infection.

A good plan is to wipe out the interior of the cavity very thoroughly with gauze and then to drain it with a loose pack of washed-out iodoform gauze. Sometimes the wiping out plan brings away the lining of the sac either in one large piece or in shreds, when the healing process is materially hastened.

After the first pus has ceased to flow, the operator must not omit to introduce one or two fingers into the sac, and with the other hand on the abdomen to gently

and lightly palpate both sides in the endeavor to locate any unruptured abscesses. If they are found, the weakest point must be noted and the wall ruptured at that place. This breaking into another abscess, as a rule, means opening the other uterine tube, or an ovary, or an ovarian abscess.

The inexperienced surgeon must be on his guard against mistaking an adherent coil of intestine for an abscess. To open a loop of the small intestine under such circumstances is a great disaster, and is sure to be followed by a protracted, distressing fecal fistula.

When the abscess is large and prominent, an experienced operator may safely follow the plan of opening it under touch

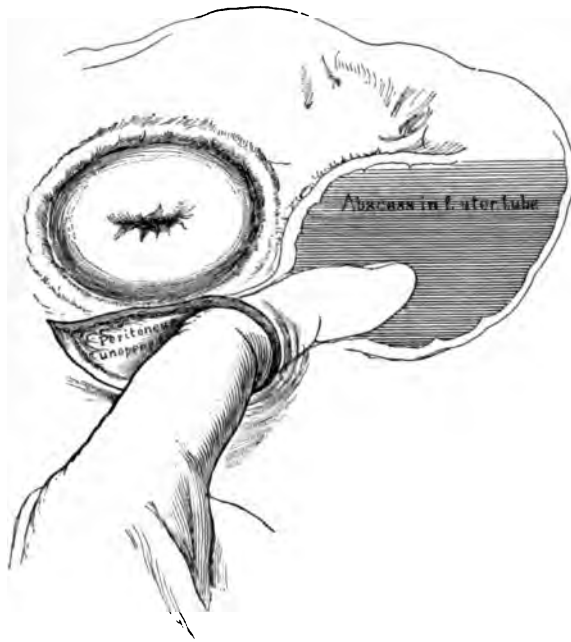


FIG. 320.—SHOWS THE FINGER IN THE ACT OF BREAKING INTO AN ABSCESS IN THE LEFT UTERINE TUBE, WITH THE PERITONEUM UNOPENED.

alone by pushing a pair of sharp-pointed scissors through the posterior vaginal wall into the abscess, spreading the points and withdrawing them opened. The uterine dilator is then inserted and the hole stretched to its utmost. In order to give this little procedure proper precision the operator introduces the index-finger into the vagina, and with the finger-tip resting on the vault, guides the scissors, while the middle finger of the same hand, touching the sac in the rectum, marks the position of that viscus, and so prevents the too deep penetration of the scissors, and consequent wounding the bowel.

When the abscess is situated laterally and is large enough to be felt low down in the pelvis, in contact with the broad ligament, G. L. Hunner's plan makes it possible to

approach the abscess and to open it without opening the peritoneal cavity. This is done by incising the vaginal vault and then, while carefully avoiding opening the peritoneum, pushing up the tissues and making a blunt dissection out in the direction of the broad ligament until the abscess is felt in contact with the finger. It may be carefully aspirated, and then opened and drained. By carrying the dissection in the opposite direction, an abscess of the other side of the pelvis can also be opened and drained without injury to the peritoneum lying between the separated sacs.

It is the custom of some operators to introduce at once a large rubber drainage-tube surrounded with iodoform gauze. If this is done care must be taken that the stiffness of the tube or its angles or projections are not likely to press continuously upon any portion of the bowel.

I prefer myself, after cleansing the cavity as above described, to stuff it loosely with a washed-out iodoform gauze drain, the ends of which hang into the vagina through the liberal opening back of the cervix. I manage the drain by leaving it *in situ* for several days, or for a week or ten days, as long as the patient is making an undisturbed convalescence. If there is a good deal of discharge, or the drain becomes foul, or the patient has any persistent elevation of temperature, I bring her to the edge of the bed, and under inspection remove the drain, gently irrigate the cavity, and insert a fresh drain or a rubber-tube drain shaped like a mushroom catheter, only larger in caliber. Through this drain the wound can be irrigated until it is so contracted that it is safe to remove the tube and let the cavity close up. There is always a tendency for the vaginal opening to close faster than the cavity above is able to granulate and fill up. This must be obviated by using a good-sized canula every two or three days, which serves the purpose of both irrigator and dilator.

It will occasionally be necessary to open up a closed orifice to let out a little pent-up pus a week or more after the closure of the opening.

For the first couple of days after opening and draining a pelvic abscess in this way, the operator must expect a sharp rise in the temperature from 101° to 103° F.

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FIG. 321.—SHOWS A GAUZE DRAIN IN POSITION BEHIND THE UTERUS. AS SEEN FROM ABOVE.

The inflamed uterine tubes should be thoroughly evacuated, after which the ovaries and tubes rest upon the gauze, which catches and transmits all the discharges to the vagina. Such a drain must be watched and kept flowing. (After Howard A. Kelly.)

If there are no subsidiary abscesses which have been overlooked, the fever quickly subsides and the patient begins a rapid course of improvement.

Rest in bed ought to be the rule for all of these poor pus-poisoned patients; and as they rest the bowels must be kept open and a nutritious diet given.

The operator will occasionally find on opening the peritoneum that he has opened a dermoid cyst. In such a case, if the operation presents no unusual difficulties, he will do best to continue the removal of the cyst by the vagina. At other times he will find he has laid bare an extrauterine pregnancy. If it is an old suppurating sac, or consists of an old walled-off hematocele, he may then finish his operation by clearing out the clots and draining freely into the vagina. If there is much fresh blood and it is a recent case, he will do better, I think, if he opens the

abdomen and performs a radical operation from above.

If the abscess turns out to be tubercular, it will be best, after a season of drainage and such improvement as can be secured in the condition of the patient, to open the abdomen from above and do a more radical operation, consisting of the removal of either one or both of the uterine tubes, or even the ablation of the uterus with its lateral structures.

It will sometimes happen, as I have noted in a number of instances, that after the abdomen has been opened for the removal of an extensively



FIG. 322.—THE APPLICATION OF THE GAUZE DRAIN IN SAGITTAL SECTION. (After Howard A. Kelly.)

inflamed and suppurating lateral structure, owing to the severity of the local condition or the general condition of the patient, or to both of these conditions combined, the risk of continuing the operation as originally planned bids fair to be very great. In a number of instances of this kind, with the abdomen still open and aided by sight and touch, acting through the abdominal incision, I have made the vaginal opening with greater precision and evacuated abscesses through the vagina which it did not seem possible to reach before the abdominal incision was made. Under such conditions a bimanual examination can be made with remarkable clearness, and the two hands, one introduced through the abdomen above and the other into the pelvis through the vaginal incision below, come into the closest possible contact without actually touching, and coöperate to the utmost possible advantage.

The gynecologic surgeon will also occasionally be called upon to treat an abscess located in the cellular tissue of the pelvis at the base of the broad ligament.

These abscesses almost invariably follow labor, and are oftenest seen within a few weeks after it. The examination reveals extensive infiltration, edema, and thickening at the roof of the vagina on one or both sides of the cervix. The sensation of fullness and density is, as a rule, quite different from that of the ordinary pelvic abscess, and the sense of fluctuation is usually absent. The location is also more distinctly lateral.

The temptation in such cases is always to wait until a more definite, well-defined, circumscribed mass can be outlined. I believe, on the whole, it is better to wait than to operate early. If many early operations are done, the operator will continually meet with disappointment, either in finding no pus at all, or at the most but small scattered foci. Such an operation is not apt to be attended by any immediate marked improvement. When the abscess is well defined it may point into the rectum toward the vagina or, following the extraperitoneal route upward, in the neighborhood of Poupart's ligaments. If an evacuation can be secured by the vagina it is always best, as the wound heals sooner. If the abscess is opened from above, the operation should be retroperitoneal. It is a good plan to make a counteropening into the vagina, if it can be done. Only dependent drainage will bring about a rapid recovery.

If the opening is lateral to the cervix, the operator should then make gently a careful blunt dissection in his effort to find and open the abscess. A sharp instrument is liable to injure large vessels or a ureter.

CHAPTER XIX.

ABDOMINAL HYSTEROMYOMECTOMY AND MYOMECTOMY.

BY CHARLES P. NOBLE, M.D.

Hysteromyomectomy and myomectomy are the operations at present employed for the removal of fibroid tumors of the uterus. As the names imply, the first of these operations is the removal of the tumor together with the uterus, and the second is the removal of the tumor alone.

History.—From an historical standpoint the development of both hysteromyomectomy and myomectomy is fraught with interest. The first deliberate operation for fibroid tumor was that of Amussat,¹ in 1840. His paper, which appeared in 1842, was carefully prepared and contained the report of two successful cases of vaginal myomectomy. He referred to the fact that neither the ancient writers nor his contemporaries believed that any fibroid tumor except a polyp could be removed. In each of his cases Amussat removed a submucous myoma through the cervix. The abdominal operations, with which we are here especially concerned, were at first performed in a spirit of bold progressiveness or from sheer necessity, after the abdomen had been opened for the removal of a supposed ovarian tumor. The earliest abdominal sections performed in cases of fibroid tumor were those of John Lizars² in 1825 and of Nathan Smith³ some time before 1831. The abdomen was opened by both for supposed ovarian tumors, and the operation was abandoned when it was learned that the diagnosis was incorrect.

Charles Clay⁴ performed the first hysteromyomectomy (November 17, 1843), the diagnosis being an ovarian tumor. He was followed by Heath⁵ (November 21, 1843). Washington L. Atlee⁶ did the first abdominal myomectomy in 1844, with a successful result. All of the other abdominal operations up to this time in cases of fibroid

¹Amussat, J. Z.: "Memoire sur l'anatomie pathologique des tumeurs fibreuses de l'uterus et sur la possibilité d'extirper ces tumeurs lorsqu'elles sont contenues dans les parois de cet organe," Paris, 1842.

²Myrtle, John Young: Report of cases of Lizars. "Case of Tumor for which Operation for Ovariectomy was Performed more than Twenty-five Years Ago," *Monthly Jour. of Med. Sci.* (Edinburgh and London), vol. xii, March, 1851, Art. 6 p. 229.

³Smith: "Medical and Surgical Memoirs of Nathan Smith." Edited with addenda by Nathan R. Smith. Baltimore, 1831, p. 231.

⁴Clay, Charles: "Observations on Ovariectomy. Statistical and Practical; also a Successful Case of Entire Removal of the Uterus, and its Appendages," *Trans. of Obstet. Soc. of London*, vol. v. 1863, p. 58.

⁵Heath, A. M.: "Case of Excision of the Uterus by the Abdominal Section," *London Medical Gazette*, vol. i, New Series, Dec. 8, 1843-44, p. 309.

⁶Atlee, W. L.: "Removal of a Fibroid Tumor of the Uterus by Gastrotomy," *American Journ. Med. Sci.*, vol. ix, No. 18, April, 1845, art. 3, p. 309.

tumor had resulted fatally. Bellinger¹ was the first to perform a deliberate hysteromyomectomy for fibroid tumor of the uterus, in 1846. The diagnosis, however, was merely "uterine tumor." The operation was followed by peritonitis and death on the fifth day. Burnham² in 1853 performed the first successful hysteromyomectomy. To G. Kimball,³ of Lowell, Mass., belongs the distinction of having performed the first deliberate hysteromyomectomy, having previously made a correct diagnosis. Happily the woman recovered.

It is a matter of interest that Kimball did a supravaginal amputation and dropped the stump, adopting the operation which, as perfected by modern methods, is today giving the best results.

Koeberlé,⁴ of Strassburg, in 1861 performed the first successful hysteromyomectomy in Europe. The diagnosis had been previously made and the operation was deliberately undertaken. The *serre-naud* was invented by Koeberlé for this operation. Hysteromyomectomy was further popularized by Péan,⁵ who with Urdy published a paper in 1873. Bardenheuer⁶ (1881), in Germany, was the pioneer in panhysterectomy; Mary Dixon Jones⁷ in 1888 performed, independently, the first total hysteromyomectomy in America.

The early surgery of fibroid tumors was beset with a number of difficulties, some of them more fancied than real. Uterine tissue was regarded as extremely vascular and hemostasis of the cut uterine surface was believed to be very difficult to secure and equally as hard to maintain. Sloughing of the uterine stump was a frequent complication and resulted in fatal peritonitis if the necrotic tissue infected the peritoneal cavity. The first efforts to meet both of these dangers resulted in what was known as the extraperitoneal treatment of the stump, through the use of the *serre-naud*, or of the elastic ligature. Thus in hysterectomy, after tying off every part of the broad ligaments down to the cervix (or in favorable cases without preliminary ligation), the cervix was dragged into the lower angle of the incision, transfixed with pins, surrounded by the *serre-naud* or by an elastic ligature, and the tumor and corpus uteri cut away. The cervical stump was left suspended by the pins, in the lower angle of the wound; so that hemorrhage could be immediately

¹ Bellinger, John: "Operations for the Removal of Abdominal Tumors," Southern Jour. of Med. and Pharm., May, 1847, vol. xi, No. 3, p. 241.

² Burnham, Walter: "Extirpation of the Uterus and Ovaries for Sarcomatous Disease," Nelson's North American Lancet, vol. viii, Jan., 1854, art. 36, p. 147. Irish, Jno. C.: "Hysterectomy for the Treatment of Fibroid Tumors, with a Report of Fifteen Cases," Trans. Amer. Med. Assoc., vol. xxix, 1878, p. 447. Report of Burnham's Case.

³ Kimball, G.: "Successful Case of Extirpation of the Uterus," Boston Med. and Surg. Jour., vol. lii, No. 13, May 3, 1855, p. 249.

⁴ Koeberlé, E.: "Documents pour servir à l'histoire de l'Extirpation des tumeurs fibreuses de la matrice par la méthode subpubienne," Gaz. Méd. Strassburg, 1864, No. 2, p. 17; No. 4, p. 66; No. 9, p. 158; 1865, No. 4, p. 78; No. 6, p. 118.

⁵ Péan et Urdy: "Hysterotomie de l'ablation partielle ou totale de l'uterus par la gastrotomie," Paris, 1873.

⁶ Bardenheuer: "Die Drainirung der Peritoneal-höhle, mit Anhang die total Extirpation des Uterus wegen Fibroid," Stuttgart, 1881, p. 271.

⁷ Jones, Mary A. Dixon: "Two Cases of Uterine Myoma: One Suprapubic Hysterectomy, the Other Complete Hysterectomy," New York Med. Jour., vol. xlviii, Aug. 25 and Sept. 1, 1888, pp. 198 and 227.

detected and controlled; and that sloughs and discharges from the cervical stump could find ready exit. In the course of the evolution of the operation to its present state, it was found that hemorrhage could be controlled by the ligation, *in their course*, of the two ovarian and the two uterine arteries. It became evident, furthermore, that the reason the cervix sloughed so frequently was because of the constricting ligatures which were placed about it to secure hemostasis, and because of the cauterization to which it was almost invariably subjected.

Emmet¹ in 1884 showed that the retroperitoneal treatment of the stump was truly an extraperitoneal method, and that it had none of the disadvantages of the older operations.

The principle of using the bladder peritoneum, combining with it the use of a posterior flap of peritoneum to cover the cervical stump, was further developed by Goffe and Dudley.² Their work established the principle of treating the stump by the retroperitoneal method, but their technic in ligating the vessels and in dealing with the cervix itself was crude.

Stimson³ in 1889 advocated the systematic ligation of the main ovarian and uterine vessels *in their course*, instead of tying off the entire broad ligament; and Baer⁴ in 1892 first satisfactorily applied Stimson's precepts in the operation of supravaginal amputation. Baer showed that by tying in their course both ovarian and both uterine arteries, and by amputating the cervix well below the internal os, hemorrhage was absolutely avoided. Baer furthermore made no attempt to disinfect the cervical canal, and consequently did not devitalize the cervical tissue. He sutured the anterior and posterior leaflets of peritoneum of the broad ligaments together, above the stump, and thus shut off the cervical canal and wound area from the peritoneal cavity. Based upon these principles Pryor⁵ and Kelly⁶ have further developed the procedure and produced the most modern form of hysteromyomectomy, which is more especially adapted to complicated cases and to intraligamentous fibroids.

Myomectomy has always been employed for pedunculated tumors and for those submucous ones easily accessible through the dilated cervical canal. When myomectomy at the present time is contrasted with hysteromyomectomy—when, in other

¹Emmet, Thomas Addis: "Principles and Practice of Gynecology," Phila., 1884, p. 612.

²Goffe, J. Riddle: "A New Method—The Intraabdominal but Extraperitoneal Method—of Disposing of the Pedicle in Supravaginal Hysterectomy for Fibroid Tumor, with Report of Four Successful Cases," Amer. Jour. Obstet., 1890, vol. xxiii, p. 372. *Ibid.*: "The Development of the Intrapelvic Treatment of the Stump after Hysterectomy for Fibroid Tumor," Trans. Amer. Gynec. Soc., 1893, vol. xviii, p. 79.

³Stimson, Lewis A.: "Ligation of the Uterine Arteries in their Continuity as an Early Step in Total or Partial Abdominal Hysterectomy," N. Y. Med. Jour., vol. xlix, March 9, 1889, p. 277. Also: "On Some Modifications in the Technique of Abdominal Surgery, Limiting the Use of the Ligature en masse," Med. News, vol. lv, No. 4, July 27, 1889, p. 93.

⁴Baer, B. F.: "A Supplementary Paper upon Supravaginal Hysterectomy by the New Method," etc., Transactions Amer. Gynec. Soc., vol. xviii, 1893, p. 62.

⁵Pryor, William R.: "Gynecology," New York, 1903. Also: "A New and Rapid Method of Dealing with Intraligamentous Fibromyomata," Med. News, vol. lxxv, No. 22, 1894, p. 602.

⁶Kelly, Howard A.: "Hysteromyomectomy and Hysterosalpingo-oophorectomy by Continuous Incision from Left to Right and from Right to Left," Johns Hopkins Hospital Bull., vol. vii, Nos. 59 and 60, Feb. and March, 1896, p. 27. "Operative Gynecology," New York, 1899. "The Evolution of my Technique in the Treatment of Fibroid Uterine Tumors," Amer. Jour. of Obstet., vol. xlii, No. 3, 1900.

words, the conservative is contrasted with the radical operation—it is in reference to the treatment of interstitial and subserous interstitial growths. In the popularizing of this conservative surgery A. Martin,¹ Kelly, Olshausen² and others have played an active part. Kelly has considerably developed the technic and has invented instruments for this operation. Zweifel³ has described a partial hysterectomy with the conservation of one or of both ovaries, as a compromise operation, which, he believes, in suitable cases offers the advantages of both and the disadvantages of neither of the typical operations. Abel⁴ and Beyea⁵ have adopted Zweifel's operation and recommend it. Péan⁶ and Doyen⁷ have devised vaginal operations for myomectomy and hysteromyomectomy with morcellation of the tumor mass, enlarging upon and developing this field, which was opened up by Atlee,⁸ Emmet,⁹ and Thomas.¹⁰

Etiology.—The etiology of fibroid tumor is obscure. What produces the growth and which constituent of the uterine wall forms its matrix is not positively known. Regarding its point of origin, it has been ascribed chiefly to two sources, viz., the blood-vessel walls and the uterine muscle. According to Gebhard,¹¹ Roesger¹² was the first to attribute the growth of myomata to changes in the walls of the uterine blood-vessels. Because of the absence of the adventitia of the arterioles in small myomata, Roesger believed that fibroid tumors originated in the longitudinal or in the cross muscle bundles of the vessel walls. Gottschalk¹³ thought that a fibroid tumor started in the very tortuous part of certain arteries of the uterine wall. He described the lumen of the vessel as being either considerably narrowed at certain points or entirely obliterated. Such a corkscrew-like section of an artery made the nucleus of a fibroid, and the remainder of the growth formed around it. Virchow¹⁴ believed

¹ Martin, A.: "Ueber Myome," Bericht über den Zweiten Kongress der deutschen Gesell. f. Gynäk., Centralbl. f. Gynäk., No. 24, June 16, 1888, S. 389. "Ueber Myomoperation," Zeitschr. f. Geburtsh. u. Gynäk., Bd. xx, 1890, S. 1.

² Olshausen, R.: "Ueber die Wahl der Operation bei Myomen," Centralbl. f. Gynäk., No. 1, Jan. 4, 1902, S. 1.

³ Zweifel, Paul: "Ueber die Behandlung der Myome," Bericht über die Verhandlungen der 8 Versammlung der deutschen Gesellschaft für Gynäkologie in Berlin, 1899. Centralbl. f. Gynäk., Bd. xxiii, 1899, S. 613.

⁴ Abel, Georg: "Dauerfolge der Zweifelschen Myomectomie," Archiv. f. Gynäk., 1898, Bd. lvii, H. ii, S. 261.

⁵ Beyea, Henry D.: "The Conservation or Preservation of the Ovaries and Functionating Uterine Tissue in the Operation of Hysteromyomectomy," Amer. Jour. of Obstet., vol. xlv, No. 3, Sept., 1901, p. 324.

⁶ Péan, J.: "Hysterotomie Vaginale," Congres Francais de Chirurgie, Paris, 1897, p. 831.

⁷ Doyen, E.: "Technique Chirurgicale," Paris, 1897, p. 404.

⁸ Atlee, W. L.: Prize Essay, "The Surgical Treatment of Certain Fibrous Tumors of the Uterus Heretofore considered beyond the Resources of Art," Trans. Amer. Med. Assoc., vol. vi, 1853, p. 549.

⁹ Emmet, Thomas Addis: "Principles and Practice of Gynecology," Phila., 1884, p. 612.

¹⁰ Thomas, T. Gaillard: "Diseases of Women," Philadelphia, 1880.

¹¹ Gebhard, Carl: "Pathologische Anatomie der weiblichen Sexualorgane," Leipzig, Hirzel, 1899.

¹² Roesger, Paul: "Ueber Bau und Entstehung des Myoma uteri," Zeitschr. f. Geburtsh. u. Gynäk., 1890, Bd. xviii, S. 131.

¹³ Gottschalk, Sigmund: "Ueber die Histogenese und Aetiologie der Uterusmyome," Archiv. f. Gynäk., 1893, Bd. xliii, S. 534.

¹⁴ Virchow, R.: "Die krankhaften Geschwülste," 1863, Bd. iii, S. 107.

that the smooth muscle of the uterine wall was the starting-point of fibroid tumors.

Various causes have been assigned for the production of such a tumor. Gottschalk (*loc. cit.*) has even suggested a parasite, but this view has received little notice. In discussions upon the subject of the etiology of fibroid tumors the influence of heredity and of sexual irritation have received especial attention. There seems to be but little doubt that many fibroid tumors are congenital. Pick,¹ Anspach,² and others have reported malformations of the uterus which were apparently due to the presence of fibroid tumor elements in the urogenital strand. It is likely that in these cases the primitive tumor prevented in a purely mechanical way the union of the Müllerian ducts. While many fibroid tumors are congenital, it is hard to say what part heredity plays in their production. There are frequent instances of fibroid tumor occurring in members of the same family, but at the present time this is looked upon more as a coincidence than as an actual example of cause and effect.

Sexual irritation is about the only cause alleged for fibroid tumor that may be spoken of as acquired. It is discussed at some length by Veit.³ Under this head may be mentioned masturbation or any form of abnormal sexual habit. It is hard to see how such irritation could actually originate a fibroid tumor; but the congestion incident to sexual irritation might easily result in the more or less rapid development of an already existing nucleus.

Much has been said of the relation between sterility and fibroid tumor. It is questionable whether sterility has as much to do with the production of fibroid tumor as the latter has in the production of sterility. There seems to be an increased proportion of fibroid tumor in the colored race. At the present time, it may be said, we do not know the real primal cause of these growths. Most of them or all of them, it may be, are congenital.

Adenomyoma is generally believed to be congenital. It may have one of several causes. In the case already referred to of Anspach (*loc. cit.*), fibroid nodules apparently prevented the union of the Müllerian ducts, with the production of a bicornute uterus. In the right horn there was no displacement of the mucosa by the fibroid nodules, whereas on the left side the mucosa had become displaced by and incorporated with the fibroid tumor, so that the left horn was represented by an adenomyoma. This explanation of adenomyoma is a very old one. A large number of observers believe that adenomyoma arises when a fibroid tumor develops in immediate relation to the endometrium. Individual glands or portions of the mucosa grow into clefts or crevices of the tumor, and in its further development these glands either maintain a connection through their ducts with the cavity of the uterus or in the process of growth the ducts are compressed, atrophy takes place, and in this way glandular tissue is contained in the substance of the fibroid tumors themselves. Cullen⁴

¹Pick, L.: "Zur Anatomie und Genese der doppelten Gebärmutter," Archiv f. Gynäk., Bd. lviii, H. 3, 1899, S. 596.

²Anspach, Brooke M.: "A Case of Adenomyoma of the Undeveloped Horn in a Uterus Bicornis," Amer. Jour. of Obstet., Oct., 1904, vol. I, p. 551.

³Veit, J.: "Handbuch der Gynäkologie," 1897, Bd. ii, p. 452.

⁴Cullen, Thomas S.: "Adenomyoma," Berlin, 1903.

has shown by serial sections that the glandular elements in many of the adenomyomata may be traced directly to the endometrium or to the mucosa of those parts of the Müllerian ducts which fuse to form the uterus. Adenomyomata may also be derived from portions of the original Wolffian body which have become snared off and displaced and which undergo development instead of atrophy; von Recklinghausen¹ is largely responsible for this view. Pick² has reported a number of cases which support it. (For a more complete discussion of the histogenesis of adenomyoma see Chapter III.)

Pathology.—(For a more detailed account of the pathologic anatomy of fibroid tumors see Chapter III.)

According to Thomas,³ the true nature of fibroids was first described in the writings of Wm. Hunter at the close of the eighteenth century. They had been previously confounded with malignant growths, of which they were regarded as a variety. Hunter described them under the name of "fleshy tubercle." Chambon (*Mal. de l'uterus*), Baillie, Bayle, and others more fully elucidated the subject. Sir C. Clark, in 1814, wrote an excellent chapter upon them which would almost answer the requirements of our day.

Fibroid tumors resemble in their structure the fibromuscular tissue of the uterine wall. They are composed of interlacing bundles of fibrous tissue and involuntary muscle. The proportion of each varies in different tumors and has given rise to variations of the simple term fibroid. Thus the terms fibromyoma, myofibroma, myoma, and fibroma have all been suggested to define these growths according to the relative amounts of their fibrous and muscular constituents. Practically, however, the terms are used indiscriminately.

Fibroid tumors, as a rule, are not very well vascularized. They commonly receive their blood-supply from the surrounding condensed musculature of the uterine wall, spoken of as the capsule, to which they are more or less closely attached. Some of them are but lightly attached and can be easily shelled out. In others the connection is closer and considerable force must be exercised to enucleate the tumor.

Fibroid tumors are usually multiple. They vary in size from small growths scarcely more than perceptible to huge masses which fill the pelvic or abdominal cavities. The heaviest fibroids on record weighed 135 (Stockard) and 140 (Hunter) pounds. They are generally spherical in shape and irregular in contour. Many bizarre forms occur. The consistency and resiliency of the tumor vary according to the preponderance of fibrous or muscular tissue. One of the various forms of degeneration may also affect the consistency in a given case. Thus a calcareous fibroid is densely hard, while an edematous one is soft. The exterior is usually smooth; the tumor is tougher than the uterine muscle and slightly paler in color. On section the surface projects beyond the capsule, has a pinkish-white color, and shows a

¹ v. Recklinghausen, Fr.: "Die Adenomyome und Cystadenome der Uterus und Tubenwandung," Berlin, 1896.

² Pick, L.: "Ist das Vorhandensein der Adenomyome des Epophoron erwiesen?" *Centralbl. f. Gynäk.*, 1900, Nr. 15.

³ Thomas, T. Gaillard: "Diseases of Women," Philadelphia, 1880.

coarsely fibrillated structure, often arranged in whorls. In some cases the surface of the section is smooth and the tumor is partly white in color. (For the histology of fibroid tumors see Chapter III.)

Fibroid tumors occur in any part of the uterus, but they are comparatively rare in the cervix. Usually there are a number of tumors in the same uterus, rarely there may be but one. The number of individual growths quite frequently is from six to eight, while as many as fifty tumors have been reported in a single uterus.

Adenomyoma.—Adenomyoma of the uterus is much less frequent than the ordinary fibromyoma. Its pathologic anatomy, etc., is discussed on page 147. In general, it may be said that this form of tumor causes a more diffuse enlargement of the uterus and that it is very often found in the neighborhood of the uterine cornua. Adenomyomata are usually not well circumscribed and they have no capsule; they may be circumscribed and nodular, however, and not at all infrequently they contain cystic spaces, which are filled with a chocolate-colored fluid. This fluid is menstrual blood escaping through the glandular tissue of the tumor in the same way that menstrual blood is discharged from the endometrium. The appearance of an adenomyoma may be so characteristic that it can be recognized by the naked eye.

Anatomic Varieties.—Fibroid tumors are divided into three varieties, depending upon their position in the wall of the uterus. The majority of fibroids begin within the uterine wall, and are therefore at first (1) interstitial; during the further growth of the tumor they either remain where they have originated (interstitial) or grow toward the endometrium or toward the serous coat of the uterus and thus become either (2) submucous or (3) subperitoneal. Submucous or subperitoneal growths by pushing the mucosa or the peritoneum before them may be entirely extruded from the wall of the uterus, to which they remain attached by a pedicle of connective tissue containing blood-vessels. Such tumors are spoken of as pedunculated. The pedicle may undergo great attenuation, and finally by the contractions of the uterus, in the case of a submucous pedunculated growth, the tumor may be expelled from the womb. Subperitoneal tumors may form adhesions to the omentum and receive a new and sufficient blood-supply from that source. In such an event the pedicle may atrophy; and either from atrophy or from atrophy plus traumatism the fibroid may become completely detached from the uterus. Torsion of the pedicle may play a part in such an atrophy and transplantation.

Intraligamentous Tumors.—In case a subperitoneal fibroid develops along the lateral borders of the uterus at or above the cervico-corporeal junction and lies within the layers of the broad ligament, the tumor is spoken of as *intraligamentary*. When the tumor grows from the posterior wall of the cervix behind the peritoneum of Douglas' cul-de-sac it becomes *retroperitoneal*. A tumor growing from the anterior wall between the bladder and vagina is spoken of as *subvesical*.

Growth and Involution.—Fibroid tumors grow slowly. A certain proportion of them never become very large. As a rule, they grow steadily, once they have gained a considerable size. Usually they enlarge rapidly during pregnancy. This

is due in part to hypertrophy of the tumor, and in part to edema. As the result of myxomatous degeneration and the formation of cysts from this or other causes, they may enlarge very rapidly. Certain tumors grow more rapidly after the menopause than before it.

During involution of the uterus following pregnancy and labor they often diminish in size and are said sometimes to disappear. Formerly it was believed that many fibroid tumors atrophy and disappear after the menopause. There is no doubt that a certain proportion of fibroid tumors do undergo involution after pregnancy and atrophy after the menopause, becoming smaller in size; but it is now known that the disappearance of a fibroid tumor by atrophy or by absorption after either pregnancy or the menopause is one of the rare exceptions in the history of these growths and is never to be expected in any particular case.¹

Effect upon the Uterus.—The uterus is commonly hypertrophied and may take almost any conceivable form, depending on the location and the size of the tumors. The hypertrophy is greater in the case of interstitial and submucous growths; the latter also lengthen and distort the endometrial cavity.

The uterine mucosa undergoes certain changes. When the endometrium is not encroached upon by the new-growth, it is frequently hypertrophied. If, however, a submucous tumor is present, atrophy of the mucosa is prone to occur, or the mucosa may be entirely eroded, exposing the capsule of the tumor.

COMPLICATIONS AND DEGENERATIONS OF FIBROID TUMORS.

A fibroid tumor may develop in the uterus and may exist without complications either in the tumor itself, in the uterus, in the uterine appendages, or in the abdominal organs. It is this theoretic condition which text-books and monographs usually describe, and it is necessary to confine the typical description of the tumor itself and of its life history to this uncomplicated condition. It must not be forgotten, however, that as seen in practice in more than half of the cases of fibroid tumor degenerations or complications are present. In a study of this subject by the author,² embracing 2274 cases, degenerations and complications were present

¹ Doran, Alban: "On the Absorption of Fibroid Tumors of the Uterus," *Trans. Obstet. Soc. of London*, 1893, vol. xxxv, p. 250. *Ibid.*: "The Disappearance or Absorption of Fibroid Tumors before the Menopause," *Jour. Obstet. and Gynec. Brit. Empire*, August, 1904, vol. vi, p. 141.

² Noble, Charles P.: "Fibroid Tumors of the Uterus: A Study of the Degenerations and Complications in 2274 Consecutive Cases," etc., *Jour. Amer. Med. Assoc.*, Dec. 8, 1906, p. 1881. "Uterine Fibroids," *Med. and Surg. Reporter*, June 2, 1894, vol. lxx, p. 775. "Development and Present Status of Hysterectomy for Fibromyomata," *Trans. Amer. Gynec. Soc.*, 1897, vol. xxii, p. 38. "The Conservative Treatment of Fibroid Tumors by Myomectomy," *Therapeutic Gaz.*, 1898, vol. xxii, p. 455. "The History of the Early Operations for Fibroid Tumors," *Amer. Jour. Obst.*, 1899, vol. xl, No. 2, p. 171. "Complications and Degenerations of Fibroid Tumors of the Uterus as Bearing upon the Treatment of these Growths," *Amer. Jour. Obst.*, 1901, vol. xlv, No. 3, p. 289. "A Study of the Degenerations and Complications of Fibroid Tumors of the Uterus from the Standpoint of the Treatment of these Growths," *Amer. Gynec.*, April, 1903, p. 297. "Report of a Case of the Invasion of a Fibromyoma of the Uterus by an Adenocarcinoma, which by Metaplasia had Assumed the Appearance of a Squamous Cell Carcinoma," *Amer. Jour. Obst.*, 1904, vol. xlix, No. 3, p. 306. "The Treatment of Fibroid Tumors of the Uterus," *Jour. Amer. Med. Assoc.*, 1904, vol. xlii, No. 21, p. 1350. "The Nature of the Indications for Operation for Fibroid Tumors of the Uterus," *Amer. Medicine*, 1904, vol. viii, No. 11, p. 451. "Myomectomy," *New York Med. Jour.*, 1906, vol. lxxxiii, No. 20, p. 1008.

in 1553 cases; that is, 68 per cent. of the cases were complicated and only 32 per cent. were uncomplicated.

Complications Involving the Adnexa.—The uterine appendages are not infrequently diseased as the result of infection. Pelvic adhesions are sometimes present also between the adnexa and the pelvic peritoneum as a direct result of the pressure to which these structures are subjected by the tumor itself. Daniel¹ found, in a statistical study of this problem in Pozzi's clinic, that there were pathologic alterations of the adnexa in 59 per cent. of the cases. These complications comprised catarrhal salpingitis, chronic parenchymatous or suppurative salpingitis, hydrosalpinx, hematosalpinx, and cystic degeneration of the ovaries. Cystic degeneration of the ovaries figured largely in the 59 per cent.

In a study of this particular subject by the author, embracing 2274 cases of fibroid tumor, complications existed in the uterine appendages or in the pelvis in 37 per cent. of the cases, and disease of the Fallopian tubes was present in 13 per cent. The following were the complications relative to the Fallopian tubes:

Hematosalpinx.....	10
Pyosalpinx, bilateral.....	33
Pyosalpinx, unilateral.....	36
Pyosalpinx and tubo-ovarian abscess.....	2
Hydrosalpinx, bilateral.....	17
Hydrosalpinx, unilateral.....	68
Hydrosalpinx and tubo-ovarian abscess.....	1
Salpingitis, bilateral.....	48
Salpingitis, unilateral.....	66
Salpingitis and pyosalpinx.....	7
Salpingitis and hydrosalpinx.....	3
Salpingitis and tubo-ovarian abscess.....	3
Fibroma of Fallopian tube.....	1
Papilloma of uterine appendages.....	1
Total.....	296

In addition, there were thirteen instances of ovarian abscess in the series.

Degenerations of Fibroid Tumor.—These tumors are subject to almost every variety of degeneration, including myxomatous, cystic, hyaline, fatty, and sarcomatous degeneration. They are subject also to edema, to necrosis, to suppuration, and to calcareous infiltration. The tumors may be telangiectatic or lymphangiectatic.

The tumors also may be complicated by carcinoma of the cervix and by carcinoma of the corpus uteri.

In this connection, as an indication that fibroid tumor need not pursue an uncomplicated course, reference may be made to such accidents of growth as the submucous position of fibroids, leading to dangerous or uncontrollable hemorrhage; the intraligamentous and subvesical development of the tumor, leading to pressure on the bladder or ureters; and the pedunculated type of tumor, which at times becomes twisted on its pedicle.

¹Daniel, Constantin: "De l'état des annexes dans les fibromes utérins," *Revue de Gynéc. et de chir. abdom.* 1 and 2, 1903, Septième année, pp. 26 and 196.

The following table shows the relative frequency of the various degenerations and complications in the tumor and uterus in 2274 cases of fibroid tumor:

Carcinoma of the corpus uteri.....	42	1.8 per cent.
Epitheliomatous infiltration of a fibroid tumor arising from adenocarcinoma of the corpus uteri by metaplasia.....	1	
Carcinoma of the cervix uteri.....	16	0.7 "
Sarcoma.....	34	1.4 "
Chorioepithelioma.....	2	
Necrosis of tumor.....	119	4.7 "
Myxomatous degeneration.....	89	3.4 "
Cystic degeneration.....	58	2.5 "
Hyaline degeneration.....	72	3.1 "
Hyaline degeneration and calcareous infiltration.....	8	0.25 "
Fatty degeneration.....	7	0.30 "
Hemorrhagic degeneration.....	13	0.57 "
Calcareous infiltration.....	39	1.7 "
Edema of tumor.....	17	0.74 "
Twisted pedicle, pedunculated tumor.....	3	0.13 "
Dangerous uncontrollable hemorrhage.....	41	
Intraligamentous development of tumor.....	80	3.5 "
Subvesical development of tumor.....	2	
Adenomyoma.....	12	
Total.....	655	

For a consideration of the pathology of the various degenerations of fibroid tumors the reader is referred to Chapter III. In this connection it must suffice to make some general remarks. Necrosis of the tumor is most common in submucous fibroids, more especially when, through the contractions of the uterus, the tumor is extruded wholly or in part into the vagina. So soon as the circulation in the tumor is shut off by the process of expulsion, necrosis follows. Unless the patient is relieved by the complete extrusion of the tumor or its removal by art, infection of the uterus and septicemia result. Necrosis of a subperitoneal pedunculated tumor occurs at times as a result of torsion. At times necrosis is the result of traumatism either from external violence, as a fall or a blow, or from within, as in the course of labor. In old women, especially when the tumors are calcareous, slight traumatism at times causes necrosis. Cystic degeneration may be the outcome of myxomatous change or necrosis; or it may result from the accumulation of fluid in one or more of the glandular areas in an adenomyoma; or it may be occasioned by the enormous dilatation of lymph-channels within the tumor. The relative frequency of the other less serious forms of degeneration is shown by the foregoing table.

Sarcomatous Degeneration.—Fibroid tumors may undergo sarcomatous degeneration, the fibromyomatous tissue being directly transformed into sarcoma. In the author's study of the subject, embracing 2274 cases, sarcoma was present in 2 per cent. Winter¹ states that in 500 cases of fibroid tumor in which grossly suspicious areas only were examined microscopically, sarcoma was present in 3.2 per cent.; but that in 253 cases of fibroid tumor in which sections were taken systematically from different parts of the tumor, sarcoma was found in 4.3 per cent. He

¹ Winter, Georg: "Die malignen und benignen Degenerationen der Uterusmyome," Zeits. f. Geburtsh. u. Gynäkol., Bd. lvii, H. i, 1906, S. 19.

believes that if myomata were examined systematically, sarcoma would be found in about 4 per cent. of all cases. In the author's personal experience in 337 cases, sarcomatous degeneration was found in two. Anspach found one case of myosarcoma in 112 consecutive fibroid tumors from Clark's service at the Hospital of the University of Pennsylvania. Pfannenstiel¹ directs attention to the possibility of mistaking a primary sarcoma for a fibroid tumor undergoing sarcomatous degeneration. This possibility should be borne in mind in the interest of exact diagnosis. In examining a fibroid tumor macroscopically, sarcomatous degeneration may reasonably be suspected if the tumor presents the appearance of hemorrhagic degeneration with the formation of small cysts. Semi-necrotic hemorrhagic areas which show no fibrillar arrangement are also highly suggestive.

Carcinoma Complicating Fibromyomata.—Carcinoma is not a form of degeneration of fibroid tumor, but it is found so often in the endometrium as an associated lesion that it deserves especial consideration.² In a study of 4880 consecutive cases of fibroid tumor, the author found that cancer was present in 2.8 per cent. Cancer of the cervix was present in 1.29 per cent. and cancer of the corpus uteri was present in 1.54 per cent. In my personal experience with 337 fibroid tumors, there were nine cases of cancer of the corpus (2.6 per cent.) and five cases of cancer of the cervix (1.4 per cent.). As in women not the subject of fibroid tumor there are ten cancers of the cervix to one of the corpus, this absolutely greater frequency of carcinoma of the corpus uteri is significant, and the author believes that it points to a causal relation between fibroid tumor and adenocarcinoma of the endometrium. This belief has been accepted also by Cullen,³ Winter,⁴ Piquand,⁵ and others. Piquand goes even further, as he states that the presence of a fibroid tumor also favors the development of cancer of the cervix.

EFFECT OF FIBROID TUMORS UPON NEIGHBORING OR UPON DISTANT ORGANS.

The effects produced by fibroid tumors upon the organs in the vicinity of the uterus and its appendages and their influence upon the circulatory system must be discussed in connection with their pathology. The uterus, being attached to the vagina and to the bases of the broad ligaments, is more or less limited in the bounds of its upward displacement, hence unless the fibroid masses are pedunculated or favorably situated at the fundus of the organ, they are retained within the pelvis, in

¹ Pfannenstiel, J.: "Zur Behandlung des myoma uteri," *Deutsche med. Wochenschrift*, Bd. xxx, No. 14, March 31, 1904, S. 490.

² Carcinoma can develop from the glandular elements contained in an adenomyoma.

³ Cullen, Thomas S.: "Immediate Examination of Uterine Mucosa and Myomatous Nodules after Hysteromyomectomy to Exclude Malignant Disease," *Jour. Amer. Med. Assoc.*, March 10, 1906, vol. xlv, p. 695.

⁴ Winter, Georg: "Die malignen und benignen Degenerationen der Uterusmyome," *Zeits. f. Geburtsh. u. Gynäkol.*, Bd. lvii, H. i, 1906, S. 11.

⁵ Piquand, G.: "Fibromes et Cancers Utériens," *Annales de Gynécol. et d'Obstét.*, July, Aug., Sept., 2nd série, 1905, Tome ii, p. 583.

which case, after they have reached even a moderate size, they may compress the pelvic structures against the unyielding bony pelvis. Fibroids developing within the layers of the broad ligament (intraligamentary) are especially dangerous in this respect. Even small fibroids in such a situation may produce serious pressure. The bladder, urethra, ureters, and rectum, are the structures most exposed to compression from a fibroid. Pressure may lift the bladder out of the pelvis so that it occupies a position between the summit of the growth and the anterior abdominal wall; it is sometimes pushed up as high as the umbilicus. Obstruction of the urethra may further this displacement through retention of urine. Occasionally the first symptom of a fibroid tumor is retention of urine due to pressure or traction upon the urethra. Pressure on one or on both ureters, with resulting hydronephrosis and hydronephrosis or even destruction of the kidney, is more common than has been taught in the past. Knox¹ reported a series of cases occurring at the Johns Hopkins Hospital in which the ureters were carefully observed at the time of operation, and in a good proportion of the cases a certain amount of obstruction was found, varying from slight compression and a small hydronephrosis up to complete obstruction with hydronephrosis. Intraligamentary growths more than any other variety of tumor may compress the ureters and in some cases displace the ureter upward so that it overrides the growth. Compression of the rectum may occur to almost any degree. This often results in atony with distention of the large bowel, chronic constipation, and difficult defecation. Autointoxication and anemia from the absorption of matter from the bowel is a common result. Absolute obstruction from pressure alone probably never occurs; although it often seems remarkable, in cases where the fibroid tumor completely fills and is tightly wedged in the pelvis, how it is possible for the bowels to move. Obstruction results when peritonitis and intestinal adhesions complicate the direct pressure upon the rectum and the atony of the colon.

Cardio-vascular Degeneration Due to Fibromyomata.—The relation of fibroid tumor to degenerative changes in the myocardium and in the blood-vessels is a problem which as yet is not definitely settled. The occurrence of brown atrophy and of fatty degeneration of the heart, of a fibroid change in the arterioles, of secondary degeneration of the kidneys, and of changes in the circulation, blood-vessels, and blood, leading to thrombosis and embolism, have all been ascribed to the influence of fibroid tumors upon the economy. The evidence is satisfactory that all these secondary changes do occur, but the frequency and the mode of their occurrence are not positively known. Hofmeier,² Fenwick,³ Strassman and Lehmann,⁴

¹ Knox, J. H. M.: "Compression of the Ureters by Myomata Uteri," *Amer. Jour. Obstet.*, vol. xlii, Nos. 4 and 5, September and October, 1900, pp. 348 and 496.

² Hofmeier, M.: "Zur Lehre vom Shock über Erkrankungen der Circulations-Organen bei Unterleibsgeschwülsten," *Zeits. f. Geburtsh. u. Gynäkol.*, 1885, Bd. xi, S. 366.

³ Fenwick, Bedford: "On Cardiac Degeneration from the Pressure of Abdominal Tumours," *The Lancet*, vol. i, May 26, 1888, p. 1015.

⁴ Strassman, P., and Lehmann, F.: "Zur Pathologie der Myomerkrankung," *Archiv. f. Gynäkol.*, 1898, Bd. lvi, H. 5, S. 503.

Boldt,¹ Pellanda,² and Winter³ have studied and written upon this subject *in extenso*. As early as 1885 Hofmeier stated that cardiac disease is a frequent occurrence in cases of abdominal tumor, and especially in cases of fibroid tumor of large size. Strassman and Lehmann studied clinically 71 patients the subject of myoma, and concluded that in 48.8 per cent. of them there were definite cardiac lesions. Boldt in a study of 79 cases found that in 37, or nearly 47 per cent., some circulatory disturbance existed. In many of the patients the symptoms might have been functional in their nature. One patient died of angina pectoris. Five of the patients died after operation. Death in three of the five patients was clearly due to cardiovascular degeneration. Pellanda states that death in the natural course of fibromyomata occurs from thrombosis of the pelvic venous sinuses and pulmonary embolism, cardiac lesions, and sudden syncope, in 11.1 per cent. of the cases. Winter, in a study of 266 cases of fibroid tumor from the standpoint of the relation of these growths to heart lesions, found that in 60 per cent. the heart was entirely normal; murmurs or impure tones were found in 30 per cent., and in almost all cases were due to anemia. Dilatation and hypertrophy were found in 6 per cent. of the cases, the majority being due to anemia. Valvular disease was found in but 1 per cent. The examination of these cases was made by a specialist in internal medicine. Winter's conclusions, therefore, are that almost all of the cardiac symptoms in cases of fibroid tumor are due to anemia, and that only in a small percentage of cases do these tumors cause degenerative changes in the heart or permanent heart lesions.

Fleck⁴ has written extensively upon this subject, basing his remarks upon eleven cases which were thoroughly studied post mortem. He says that the exact relation and nature of the circulatory and the cardiac changes associated with myoma are obscure. Sudden death sometimes follows operation for fibroid tumor, when there can be no other reason assigned than some inherent weakness of the heart muscle. Such startling accidents have happened in spite of an absence of the physical or the subjective signs which indicate a cardiac lesion.

Obstruction to the circulation produced by the myoma is one of the reasons advanced for the production of the heart lesion. Fenwick⁵ in 1888 reported twenty-two cases of large abdominal cystic tumors, in which at post mortem fatty degeneration of the heart muscle was found. This theory has been controverted on the ground that no such condition is observed during pregnancy, and also that cardiac symptoms occur in connection with small tumors. Fenwick believes the obstruction to the circulation in large tumors cannot be compared to that which takes place during pregnancy. The reason for this is twofold: First, in pregnancy the heart

¹Boldt, H. J.: "Uterine Fibromyomata and Visceral Disease," N. Y. Med. Jour., Oct. 28, 1905, vol. lxxxii, No. 2, pp. 887-895.

²Pellanda, C.: "La Mort par Fibromyomes Utérins," Paris, 1905.

³Winter, Georg: "Die wissenschaftliche Begründung der Indikationen zur Myomoperation," Zeits. f. Geburtsh. u. Gynäkol., 1905, Bd. lv, S. 109.

⁴Fleck, Georg: "Myom und Herzerkrankung in ihren genetischen Beziehung," Archiv. f. Gynäk., Bd. lxxi, H. i, 1904, S. 258.

⁵Fenwick, Bedford: "On Cardiac Degeneration from the Pressure of Abdominal Tumors," The Lancet, vol. i, May 26, 1888, p. 1015.

undergoes a physiologic hypertrophy; and, second, the distention of the abdomen in pregnancy occurs only in the last two months. The short duration of the distention from pregnancy is in marked contrast to the long duration of the distention from a tumor.

In Fleck's cases, eleven of which were examined post mortem, brown atrophy was found in seven. Other lesions were fatty degeneration, fatty infiltration, and chronic endocarditis. In six of the eleven patients there had been no history of bleeding.

From my own experience I do not believe that cardio-vascular degeneration plays a large rôle in producing fatal results in fibromyomata of the uterus, either in the natural history of the disease or after operation, except in neglected and late cases. As a rule, the changes are secondary to the anemia which results from hemorrhages, or to malnutrition, produced either by hemorrhage or by disturbance of digestion from pressure of the tumors. Interference with the circulation by pressure of the tumors also plays its rôle in the production of thrombosis, phlebitis, and embolism.

Anemia.—Anemia from more or less persistent hemorrhage is one of the most common results of fibroid tumor. According to Winter,¹ hemorrhage occurs in about two-thirds of all cases of myoma and is most frequent in those of the submucous type. My own experience would not indicate so large a percentage in general; but in submucous fibroids it is always present, is often very profuse, and leads to profound anemia. I have reported two cases of this type. In one the hemoglobin was reduced to 10 per cent., the erythrocytes to 2,325,000. The patient was curetted to control the bleeding, and later had a hysterectomy, making a good recovery. In the other the hemoglobin was reduced to 15 per cent. and the erythrocytes to 1,016,000. This patient also made a good recovery.

Grave anemia is a serious condition which produces profound invalidism while it lasts, and sometimes it is fatal or impossible to cure. A fatal result due to acute hemorrhage is rare. Pellanda,² in a study of 171 cases of death from fibromyomata without operation, states that in 6.4 per cent. of the fatal cases death was due to hemorrhage. The more usual result of grave anemia is that, finally, the patients are operated upon and their unfavorable condition tends to swell the mortality of operation.

The relation of cardiac weakness and of kidney insufficiency to anemia is well recognized. These secondary complications of fibroid tumor lead to a fatal termination in a certain percentage of cases, without operation, and the same complications, together with the alterations in the blood-stream which are due to pressure of the tumor, constitute the chief underlying causes of thrombosis and embolism following operation, a result which would be avoided by an early removal of the tumors.

¹ Winter, Georg: "Die wissenschaftliche Begründung der Indikationen zur Myomoperation," *Zeits. f. Geburtsh. u. Gynäkol.*, 1905, Bd. lv, S. 59.

² Pellanda, C.: "La Mort par Fibromyomes Uterins," Paris, 1905.

Thrombosis, Embolism, and Phlebitis.—Thrombosis, embolism, and phlebitis are three complications which are encountered more frequently in connection with fibroid tumor than with any other gynecologic condition. All three are much more common after operation than in the natural history of the disease. Thrombosis and phlebitis usually affect the pelvic veins or the veins of the left leg. Less often the right leg is involved secondarily, and rarely the right leg is primarily attacked. One case of thrombosis and phlebitis in the veins of the neck and left axilla has come under my observation. Sudden death after operation for fibroid tumor is much more frequently due to thrombosis and pulmonary embolism than to diseases of the heart. Schenck¹ reports a series of operations upon 7130 women in Kelly's clinic at the Johns Hopkins Hospital. Post-operative thrombosis occurred forty-eight times. In nineteen of these cases thrombosis followed operations for fibroid tumors, of which there were 727 cases. Thus the women having fibroid tumors, although constituting but 10 per cent., furnished over one-third of the cases of thrombosis. As an indication that infection plays but a minor rôle in the development of thrombosis, there was but one case of thrombosis in the entire series among the operations done for pelvic inflammation.

Baldy² states that of 19 patients who died suddenly after operation in his hands, 13 were in cases of fibroid tumor, whereas the cases of fibroid tumor numbered but 366 out of a total of 3413 patients. The experience of Schenck and that of Baldy is quite in accord with my own.

The causes of thrombosis, embolism, and phlebitis are by no means definitely known. There is no doubt that infection is the cause of thrombophlebitis in a certain proportion of cases, but the fact that thrombosis and phlebitis occurred nineteen times in fibroid tumors and only once in pelvic inflammatory disease (Schenck) is sufficient evidence that there are other factors than infection in the production of these allied conditions. Anemia, increase in the number of white blood-cells and blood-plaques and changes in the relation of the chemical constituents of the blood, slowing of the blood-stream, abnormalities in the walls of the veins, and traumatism, are all factors. It is evident that fibroid tumors in their development bring about such changes in the blood and circulation as to favor the development of thrombosis, embolism, and phlebitis.

SYMPTOMS.

Hemorrhage.—One of the common symptoms of fibroid tumor of the uterus is menorrhagia or metrorrhagia. It is generally admitted that menstruation is the result of a diapedesis of the red blood-cells through the walls of the endometrial capillaries. The conclusion is rational, therefore, that anything which produces an unusual congestion of these vessels will result in an increased loss of blood at the

¹Schenck, Benjamin R.: "A Résumé of Forty-eight Cases of Post-Operative Thrombosis," N. Y. Med. Jour., Sept. 6, 1902, p. 401.

²Baldy, J. M.: "The Mortality in Operations upon Fibroid Tumors of the Uterus," Amer. Jour. Obstet., 1905, vol. lii, No. 3, p. 370.

menstrual period. A fibroid tumor originating within the uterine wall has more effect on the venous than on the arterial circulation. Thus, the venous walls being thin and non-resistant are easily compressed, while the thicker, muscular, and pulsating arteries are able to resist this pressure. It thus happens that while the same amount of blood enters the endometrium, the return flow, because of the venous compression, is embarrassed and abnormal congestion of the endometrium ensues. At the menstrual period this results in an increased menstrual flow (Clark¹). The menstrual symptoms of the patient depend upon the direction of growth which the tumor assumes. It is to be remembered that fibroids are usually multiple, and that what is being said applies to none but typical cases; in the atypical cases almost any variation may exist. When the interstitial growth remains interstitial the menorrhagia increases according to the increase in growth of the tumor. If, however, the tumor approaches the mucosa and becomes submucous, there is a disproportionate increase of menorrhagia, and finally a metrorrhagia, the latter due to a rupture of the vessels in the thinned-out mucosa or to an actual erosion of the mucosa. When the fibroid grows toward the peritoneum (subperitoneal tumor) the menstrual flow gradually becomes less, and in case the tumor is extruded entirely outside the uterine wall, there may be no menorrhagia. Practically, as said before, these mechanics of the hemorrhage in myoma are scarcely ever typically illustrated, for the reason that very often all three varieties of fibroid tumor are found in the same uterus. A single submucous fibroid the size of a pea may occasion more alarming hemorrhage than fibroids of large size which are interstitial or subperitoneal in type.

Pain.—Pain is a variable symptom of fibroid tumor; in the majority of cases it occurs, from one cause or another. Occasionally there is no pain whatever or it appears only after the tumor has reached considerable proportions. Instead of actual pain, there may be a feeling of general pelvic discomfort. Uncomplicated subperitoneal fibroids are least apt to produce pain. Adenomyomata are usually painful, especially at the menstrual period. In many cases pain is due to complications.

Intermenstrual pain may be caused by the contractions of the uterine wall made in an effort to push an intramural nodule toward the mucosa (submucous position) or toward the serosa (subserous or subperitoneal position), or in the case of a submucous tumor, in an effort to expel the growth from the uterus. Pain is much more pronounced with tumors of the submucous type. Here it accompanies menstrual activity and constitutes a form of dysmenorrhea. Dysmenorrhea of this sort is sometimes one of the earliest symptoms of fibroid tumor. Adenomyomata cause painful menstruation for the reason that the glandular tissue or areas of mucous membrane contained in these tumors menstruates, and as the blood cannot escape it accumulates in the tumor and causes pain. Also this is one of the modes in which cystic degeneration takes place. Pain is also produced by the pressure of the tumor upon the surrounding parts. Depending on the part or

¹Clark, J. G.: "The Cause and Significance of Uterine Hemorrhage in Cases of Myoma Uteri," *Johns Hopkins Hosp. Bull.*, vol. x, Nos. 94-96, Jan., Feb., and March, 1899, p. 11.

parts most compressed, this may resemble pain from any sort of pelvic trouble. Pressure on the bladder and rectum may result in vesical or rectal irritability of various grades. These symptoms are more often due to venous obstruction caused by the tumors. Pressure upon the nerves coursing through the pelvis on their way to the extremities produces neuralgic pain referred to the area of their distribution. Pain in fibroid tumor may also be due to torsion of the pedicle of a subserous growth or to a twisting of the entire myomatous uterus upon the cervix.

Obstruction of the ureter, inflammatory affections of the uterine appendages, and inflammation following infection of the growth itself are all sources of pain. It will thus be seen that pain as a symptom of fibromyoma depends entirely upon the situation and size of the growth and upon its complications. Adenomyomata form an exception: These tumors are almost always painful, especially at the menstrual period.

Leukorrhea is present in many cases of fibroid tumor. This is either the excretion from the hypertrophied mucous membrane, the transudation of serum from distended lymphatics in a submucous tumor, or the purulent debris from a submucous myoma undergoing degeneration, in which case it is usually blood-stained and has an offensive odor. Leukorrhea as a symptom has little diagnostic value in this disease. For in the cases where it is most pronounced there is coincident hemorrhage and the leukorrhea loses its identity.

Anemia in fibroid tumor usually depends entirely upon the amount of blood which has been lost. In cases complicated by necrosis and suppuration or by kidney insufficiency there may be a toxic factor also in the condition of the blood. There is not the cachectic appearance in cases of fibroid tumor which occurs in carcinoma or in proliferating cysts of the ovary. As a rule, the anemia is quickly recovered from after the cause has been removed.

Cardiac insufficiency is indicated by shortness of breath, edema of the lower limbs, and attacks of palpitation.

Results of Pressure.—Edema of the lower extremities, varicosities in the femoral and saphenous veins, and hemorrhoids may result from intrapelvic pressure. This is true, also, of albuminuria, ischuria, hydronephrosis, hydronephrosis, obstipation, rectal and vesical irritability. After fibroid tumors reach a certain size they cause abdominal enlargement. Tumors of even moderate proportions are sometimes observed by the patient when the growth is pedunculated and lies above the pelvic brim.

The Age of Women Operated upon for Fibroid Tumors.—This subject is of interest in itself, and is also of value in determining the causes of hemorrhage in women at various periods of life. In the first 187 women operated upon by the author, the ages were classified in decennial periods, as follows:

Under twenty	1
Between twenty and thirty	6
Between thirty and forty	77
Between forty and fifty	76
Between fifty and sixty	20
Between sixty and seventy	7

And in the last 100 women:

Between twenty and thirty.....	2
Between thirty and forty.....	36
Between forty and fifty.....	45
Between fifty and sixty.....	14
Between sixty and seventy.....	3

Thus of 287 women who were driven to operation because of fibroid tumors, 48, or 16 per cent., were beyond fifty years of age. The youngest woman having a fibroid tumor in my experience was aged seventeen. Scharlieb reported an operation for a fibroid tumor in a girl aged fifteen, in which she was assisted by Stanley Boyd ("British Gynec. Jour.," Nov., 1901, p. 193).

DIAGNOSIS.

The diagnosis of a fibroid tumor is usually easy; sometimes it is difficult; and always it is subject to error unless certain conditions with which a fibroid may be confused, are kept in mind.

Bimanual palpation is here, as elsewhere, the *sine qua non* of gynecologic diagnosis, and chiefly upon it the diagnosis of fibroid tumor will depend. However, certain of the symptoms already discussed often suggest to the physician the probability of the presence of a fibroid tumor. Abdominal examination also, occasionally more appropriate than bimanual, can furnish positive evidence. The history of the case, carefully elicited, is often useful in suggesting the correct diagnosis, but in the end this usually depends upon bimanual palpation.

When the disease has existed for some time and there is much suffering, increased menstrual flow, and bleeding between the periods, there will be more or less anemia. The anemia associated with fibroid tumor differs from that of the advanced stages of malignant disease of the uterus. The color of the skin is yellowish-white instead of yellowish-brown as in true cachexia. Emaciation does not occur, but, on the contrary, a woman having a fibroid tumor is apt to put on fat. It should not be forgotten, however, that in cases of cancer there may be no cachexia until late in the disease. Fibroid tumor usually occurs at an earlier period of life than carcinoma. Symptoms alone, however, can do no more than direct our method of examination. It is from the objective signs, abdominal or bimanual palpation, or in difficult cases, of submucous tumor, from intrauterine exploration, that one is able to make a positive diagnosis. An abdominal enlargement produced by fibroid tumor of the uterus may closely simulate that from a pregnant uterus, an ovarian cyst, or from ascites, but there are a number of peculiarities which characterize a fibroid tumor. Thus, in the case of a large firm or solid tumor distending the abdomen, if smaller nodules are found upon its surface, making its exterior very knobby and irregular, there is strong presumptive evidence of fibroid tumor, and if these smaller tumors are felt to be pedunculated and attached to the larger tumor, the evidence is all but positive. The position of the abdominal enlargement is of some value in diagnosis. A pregnant uterus and an ovarian cyst, unless malignant or intraligamentary, usually

occupy a median position in the abdominal cavity. A fibroid tumor large enough to distend the abdomen is commonly located more or less on one side of the median line. This is explained by anatomic peculiarities. The ovarian tumor, free to move upon its pedicle, and also the pregnant uterus, naturally take the position where there is the most room. The elastic character of a cyst and of a pregnant uterus contribute to this result. The fibroid uterus, irregular in shape and solid in consistency, is quite likely to present its greatest enlargement to one or the other side of the fundus, and hence its prominence in the abdominal cavity is found to one or the other side of the median line. This result is influenced also by the projection of the spinal column into the abdominal cavity, which is more apt to deflect a solid than a cystic tumor. The shape of the abdominal distention in fibroid tumors also serves to differentiate these growths from others. Thus the abdominal wall will drop suddenly to its normal level above the upper confines of the tumor. In ovarian cyst or pregnancy the descent is more gradual. In consistency fibroid tumors are firm, or even densely hard, and somewhat resilient. Consistency would be one of the points in a diagnosis between pregnancy and an intramural or a submucous fibroid, causing a symmetric enlargement of the uterus. In pregnancy the uterus changes its consistency (hardening from intermittent contractions) under the palpating hand. In fibroid tumor a change in consistency occurs before the menstrual periods (premenstrual softening), when the tumor also becomes larger because of the menstrual congestions. A permanent change in the consistency of a fibroid may result from one of the forms of cystic degeneration. Even without degeneration a myoma may be quite as soft as a dermoid cyst, or as the distended upper segment of a pregnant womb, and it is sometimes most difficult to distinguish between them by this means alone. The results upon percussion are the same with fibroid tumor as with pregnancy and ovarian cyst. In all tumors there is dullness over the summit of the growth with coronal resonance. In ovarian cyst and in ascites there is fluctuation; over an ovarian cyst this may be found only in certain areas corresponding to the position of the main loculi. If the cyst is made up entirely of smaller loculi there may be no fluctuation. The physical signs of uncomplicated ascites should never be confused with those of fibroid tumor and need not be discussed. However, ascites may be a complication of fibroid tumor. This is most apt to occur in those cases accompanied by torsion of the growth, either of itself alone if pedunculated, or of the entire uterus if the tumors are sessile or intramural.

The result of bimanual palpation of the uterus in fibroid tumor depends entirely upon the number and situation of the growths. They are usually multiple, and although one or the other variety predominates, several varieties are commonly found in the same uterus. It will simplify a consideration of the diagnosis to deal with each variety of tumor separately.

Submucous Fibroid.—When the tumor is submucous the uterus will be enlarged and the enlargement will be more or less symmetric. The organ feels harder than the pregnant uterus. In differential diagnosis a pregnancy can be recognized

from the sixth to the tenth week¹ by obtaining semi-fluctuation in the corpus uteri and by noting the fairly uniform projection or jutting out of the corpus from the cervix antero-posteriorly and laterally. After the tenth week pregnancy can be diagnosticated by means of Hegar's sign. A subperitoneal fibroid tumor when associated with ascites at times simulates pregnancy, more especially if the tumor is pedunculated and ballottement can be elicited. Montgomery² has reported such a case. When the tumor is pedunculated, it sometimes presents in the cervical canal and may be felt through the dilated cervix. The tumor may project through the cervix and hang by a pedicle into the vagina; it can be confused then only with an inverted uterus, a pedunculated sarcoma, or the placental remnants of an abortion. An inverted uterus may be distinguished by the absence of the fundus above the cervix, as determined by bimanual palpation with a finger in the rectum, by the presence of mucosa

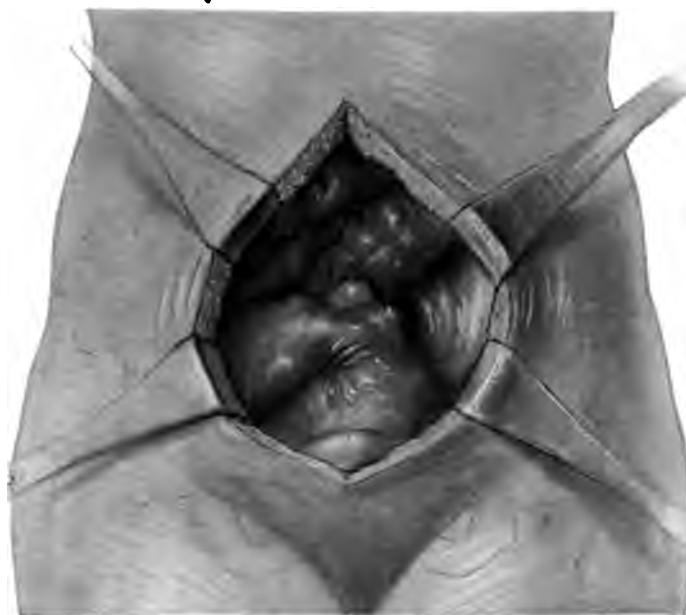


FIG. 323.—MYOMA SIMULATING PREGNANCY. (CASE OF E. E. MONTGOMERY.)

covering the surface of the mass, and by recognizing the tubal ostia. In the diagnosis of small submucous tumors intrauterine exploration by means of the finger, sound, or curet may be essential. The growth can be readily felt in this way, and its position positively determined. Such an exploration should never be undertaken without full aseptic precautions, and not unless pregnancy can be excluded.

Interstitial Fibroid.—When the enlargement is symmetric and the growth small it is sometimes difficult to distinguish the condition from pregnancy. A careful examination, under anesthesia, if necessary, will usually settle the diagnosis

¹ Noble Charles P.: "The Diagnosis of Pregnancy During the First Three Months," *Trans. Phila. Co. Med. Soc.*, 1894.

² Montgomery, E. E.: "Practical Gynecology," *Phila.*, 1900, pp. 581 and 582.

by locating one or more fibroid nodules in the wall of the uterus. If the diagnosis remains in doubt, time and the recurrence of menstruation, on the one hand, or the rapid development of the pregnant uterus on the other, will solve the problem. In this variety of tumor the uterus is irregular in outline, bulging more on one surface than on the other, and is of increased density. The uterine body cannot be outlined as distinctly separate from the mass. The only way to determine positively the relation of the endometrial cavity to the tumors is to introduce a sound. It is seldom advisable to resort to the use of the sound except upon the operating table, when it may be of value in determining the propriety of myomectomy.

Subperitoneal Fibroid.—When it is possible to recognize by bimanual palpation that the uterus is studded with hard, knob-like protuberances, the diagnosis of

fibroid tumor is clear. If the tumors are small, multiple, and pedunculated, the condition can scarcely be mistaken. When the growths are confined to one side of the uterus, or to the fundus, the uterus may be clearly outlined as a distinct body, to which the tumors are attached.

When the tumor is pedunculated it must be differentiated from an ovarian growth. This may be done by isolating the ovary upon the affected side by bimanual palpation. If both ovaries can be isolated by bimanual palpation (which frequently will be im-



FIG. 324.—MYOMA SIMULATING PREGNANCY, SHOWING TUMOR. (CASE OF E. E. MONTGOMERY.)

possible), an ovarian growth can be excluded and a diagnosis of fibroid determined. The consistency and irregular outline of the fibroid tumor may be sufficient evidence of its nature. If the fibroid tumor is large enough to distend the abdomen and the abdominal mass is drawn upward, the uterus will immediately follow. This is not true of an ovarian tumor.

Intraligamentary Fibroid.—An intraligamentary fibroid is readily recognized. It is situated low in the pelvis, to one side of the uterus in the broad ligament. Frequently the tumor is so low as to project toward the vagina, and is thus easily felt by the examining finger. Because of its location and attachments an intraligamentary fibroid is but slightly movable.

Cervical Fibroid.—Fibroid tumor of the cervix is readily recognized, because from its location it is easily reached by the examining finger and its characteristics

made out. It should be carefully palpated and inspected in order to locate accurately its relation to the cervical canal and the external os. This variety of tumor presents no real difficulties in differential diagnosis, as the other tumors of the cervix, sarcoma and carcinoma, differ so markedly from it that the diagnosis is plain.

Differential Diagnosis.—The differential diagnosis between fibroid tumor and ovarian tumor has been discussed; also the differential diagnosis between fibroid tumor and uterine pregnancy. There are certain other conditions which at times present difficulties in differential diagnosis.

Abdominal pregnancy advanced to or beyond the sixth month, with the death of the fetus and the absorption of the liquor amnii, may present difficulties in differential diagnosis. One such case was referred to me as a fibroid tumor, the diagnosis having been made by a number of physicians.¹ In this case the differential diagnosis was made by feeling the sutures in the fetal skull, which could be made out upon vaginal examination. A carefully elicited history, which included the symptoms of pregnancy and of false labor, was of value in arriving at a correct diagnosis. After the death of the fetus and the absorption of the liquor amnii, an abdominal pregnancy becomes such a solid mass that unless something characteristic (such as the sutures in the skull or a fetal bone) can be felt, it can easily be mistaken for a fibroid tumor. The diagnosis can be established by means of the X-ray.

Pelvic inflammatory masses usually do not simulate a fibroid tumor. Occasionally, however, the differential diagnosis is difficult or impossible. This is true especially when there has been a suppurative peritonitis with a very extensive exudate which has undergone organization. A typical example is that of a woman who had been confined to bed with recurring pelvic abscesses for six months. The abscess would discharge from time to time through the bowel and then refill. A diagnosis of pelvic abscess complicating a fibroid tumor was made by her physician, Laura S. Chapin, who has had a large experience in gynecologic diagnosis. Upon examination the uterus was found fixed by organized pelvic exudate; Douglas' pouch was comparatively empty; there were no bulging masses; the cervix was continuous, with a large hard mass firmly fixed against the anterior abdominal wall and extending half-way to the umbilicus, the tumor being more prominent to the left of the median line. The author concurred in the diagnosis, but the fixity of the mass suggested the possibility of cancer. At operation it was necessary to open the abdomen above the umbilicus, as there was no free abdominal cavity below it. The intestines and the posterior, lateral, and anterior abdominal walls, were fused together by a mass of partly organized exudate. The peritoneum in the median line anteriorly was about an inch in thickness, the thickening being due to the organized exudate. The anterior abdominal wall and the intestines were separated sufficiently to gain entrance to the pelvis, when a left pyosalpinx was removed. No tumor, either uterine or ovarian, was present.

Cancer of the pelvis arising in the ovary or elsewhere and involving the pelvic

¹ Noble, Charles P.: "Preliminary Report of an Operation for Abdominal Pregnancy of Twenty-one Months' Duration," Phila. Med. Jour., May 30, 1903.

tissues in general is differentiated from fibroid tumor by the fixity of the infiltration and the lack of definite outline which is characteristic of a fibroid tumor. The differential diagnosis may be doubtful or impossible when the fibroid tumor is complicated by pelvic suppuration with extensive cellulitis in the parametria. Cases of this kind have come under my observation in which a reasonably satisfactory diagnosis was only possible after opening the abdomen.

TREATMENT.

Indications for Operation.—The classic teaching with respect to the treatment of fibroid tumors was based upon the view that these growths are essentially benign. It was well recognized, however, that they may give rise at times to serious hemorrhage and subject the pelvic organs to injurious compression. But unless such conditions arose they were considered as being amenable to palliative treatment, which should alleviate the suffering of the patient and carry her in comparative comfort to the menopause, when it was held that the tumors would undergo atrophy in common with the uterus and ovaries. The palliative measures employed were directed chiefly toward the hemorrhage and the growth of the tumor. Ergot was administered with this double purpose. By maintaining firm uterine contraction it was hoped that bleeding from the uterus would be checked, and that the tumor, being deprived of its customary blood-supply, would undergo atrophy, or at any rate be retarded in its growth. Moreover, active contraction of the uterus, stimulated by the administration of ergot, would occasionally result in the expulsion of the new-growth. With the same object various drugs, such as hydrastis, hamamelis, and the salts of ammonia and potash, were employed. The favorable result obtained in certain cases through the employment of drugs was due to the expulsion of a submucous fibroid or to the migration of an intramural one to a subserous position. As a rule, the results were negative or harmful. When a cure was effected by the expulsion of a submucous fibroid the patient was subjected to the risk of sepsis from necrosis of the tumor—a risk greater than that of the removal of the tumor by operation. The use of electricity was at one time widely recommended and extensively employed, but the practice has been abandoned because the result was only palliative, and the risks entailed were as great as those of radical removal. At the present day the classic teaching in respect to the indication for operation is far from being generally accepted, and few modern surgeons employ drugs or electricity in the treatment of fibroid tumors.

There are several reasons for this change. It has become recognized that drugs are practically useless, and the apparent good they do is usually the result of a fortunate accident in the life-history of the tumor. The teaching that fibroid tumors atrophy or disappear after the menopause has been greatly modified and in large part abandoned. It is true that at times fibroid tumors shrink after the menopause, but there is no evidence that they disappear. On the other hand, many fibroid tumors grow more rapidly after the menopause than before it. Also the various

degenerations, and especially necrosis, are more common during and after than before the menopause. Furthermore, the surgery of these growths has made rapid strides and is certain and brilliant in its results, and is attended with but little danger to the patient. With the appreciation of this change in the actual value of the two lines of treatment has come a better knowledge of the pathology of fibroid tumors and a realization of the fact that these tumors are dangerous not only from the hemorrhages and the injurious pressure upon adjacent structures which they cause, but also from changes which occur in the growths themselves, and from the associated lesions which are produced in the pelvic organs and in the urinary, alimentary, and circulatory systems. The fact that sarcoma develops in about 2 per cent. of fibroid tumors, and that carcinoma attacks the uterus in 2.8 per cent. of women having fibroid tumors, has influenced surgeons to favor the removal of these growths.

The author,¹ in 1901, reported a series of 218 cases of fibroid tumor, with a critical study of the conditions found at operation, for the purpose of pointing out that, in his opinion, the profession had not yet had a proper estimate of the complications, degenerations, and dangers of fibroid tumors. At that time the question had not been considered from such a standpoint. Martin,² in 1888, reported a series of cases in which he tabulated the various forms of degeneration which may occur in the fibroid tumor itself, but made no reference to the complications found elsewhere.

Within the past five years a number of authors, notably Cullingworth,³ Frederick,⁴ Scharlieb,⁵ Hunner,⁶ McDonald,⁷ and Webster,⁸ have made similar studies of consecutive cases of fibroid tumors with almost identical results.

As a result of the interest excited in this method of studying fibroid tumors, the author was enabled in 1906 to present a study of the degenerations and complications in 2274 consecutive cases, and also a study of 4880 consecutive cases in their relation to carcinoma and sarcoma of the uterus.⁹

¹ Noble, Charles P.: "The Complications and Degenerations of Fibroid Tumors of the Uterus as Bearing upon the Treatment of these Growths," *British Gynec. Jour.*, 1901, vol. xvii, No. 67, p. 170.

² Martin, A.: "Ueber Myome," *Bericht über den Zweiten Kongress der deutschen Gesell. f. Gynäk.*, *Centralbl. f. Gynäk.*, No. 24, June 16, 1888, S. 389.

³ Cullingworth, Chas. J.: "An Analysis of One Hundred Cases of Uterine Fibromyoma," *Jour. Obst. and Gynec. British Empire*, vol. i, No. 1, January, 1902, p. 3.

⁴ Frederick, Carlton C.: "A Study of Uterine Fibromata with Especial Reference to their Degenerations and Complications as Furnishing Reasons for Early Operation," *Amer. Gynec.*, vol. i, No. 3, Sept., 1902, p. 255.

⁵ Scharlieb, Mary: "An Analysis of One Hundred Cases of Fibro-myoma Uteri," *Jour. Obstet. and Gynec. British Empire*, vol. ii, No. 4, October, 1902, p. 323.

⁶ Hunner, Guy L.: "One Hundred Consecutive Cases of Myoma of the Uterus," *American Medicine*, vol. vi, No. 2, 1903, pp. 55-57.

⁷ McDonald, Ellice: "Complications and Degenerations of Uterine Fibromyomata," *Jour. Amer. Med. Assoc.*, vol. xlii, No. 21, May 21, 1904, p. 1344.

⁸ Webster, J. Clarence: "A Consideration of Fibroid Tumors of the Uterus Based upon a Study of a Series of 210 Cases Treated Surgically," *American Medicine*, March 11, 1905, p. 401.

⁹ Noble, Charles P.: "Fibroid Tumors of the Uterus: A Study of the Degenerations and Complications in 2274 Consecutive Cases, including 337 cases of the writer's; also a Study of 4880 Consecutive Cases in their Relation to Carcinoma and Sarcoma of the Uterus," *Jour. of Obstet. and Gynec. of the Brit. Empire*, 1906, vol. x, No. 5, p. 436; *Jour. Amer. Med. Assoc.*, Dec. 8, 1906, p. 1881.

Martin.....	205
Noble.....	337
Cullingworth.....	100
Frederick.....	125
Scharlieb.....	100
Watt-Keen ¹ (Hofmeier's Clinic).....	300
Hunner.....	100
McDonald.....	280
Lauwers ²	200
Eastman ³	117
Webster.....	210
Martin, F. H. ⁴	200
Total.....	2274

For a study of the relation of fibroid tumors to sarcoma and carcinoma of the uterus, in addition to the 2274 cases, 2206 additional consecutive cases were obtained; 1607 from Winter⁵ and 999 from Kelly's clinic at the Johns Hopkins Hospital (private communication).

The study of so large a series of cases must furnish reasonably correct data, as the element of chance always present in a small series is eliminated. The cases reported by each author were consecutive, and were studied with the object of reporting the degenerations and complications present. It was found that 68 per cent. were complicated either by degenerations in the tumor or by disease in the uterine appendages or elsewhere; that is, in only one-third of the cases of fibroid tumor as seen in the operating room does the disease exist in an uncomplicated condition. It was estimated that in 275, or 12 per cent., of the 2274 cases the women would have died without operation from degenerations or complications existing in the tumor or uterus at the time of operation; and that 252, or 11 per cent., of the women would have died without operation as a result of the complications existing in the uterine appendages or abdomen. Numerous other complications existed, causing invalidism to the patient in addition to those classified as fatal. The conclusion was drawn that approximately 30 per cent. of women having fibroid tumors as seen in the operating room would die without operation in the natural course of the disease and its complications. Some of the more important complications and degenerations will be found on pages 667-670.

As a result of the gradual increase in knowledge as to the real dangers of fibroid tumors and their degenerations and complications, the attitude of the profession toward the treatment of these growths has greatly altered. Surgical opinion is almost unanimous that fibroid tumors which produce symptoms or which are growing should be removed. The question now is whether it would not be better to remove every fibroid as soon as it is found, irrespective of the symptoms it is pro-

¹ Watt-Keene: Inaug. Dissert., Wurzburg, 1902.

² Lauwers, E.: "Deux cents observations d'hystérectomie supravaginale pour fibrome," Bruxelles, Ch. Buleus, 1904.

³ Eastman, Thomas B.: "Shall we Remove all Fibromyomata of the Uterus on Diagnosis?" Amer. Jour. Obst., 1904, vol. I, p. 678.

⁴ Martin, F. H.: "Fibroid Tumors of the Uterus: Their Surgical Treatment," N. Y. Med. Jour., 1905, vol. lxxxii, p. 1217.

⁵ Winter, Georg: "Die malignen und benignen Degenerationen der Uterusmyome," Zeitschr. f. Geburtsh. u. Gynäk., 1906, Bd. lvii, H. i, S. 10.

ducing at the time, unless there exist good reasons to the contrary in the particular case.

In considering the question of operation in an uncomplicated case of fibroid tumor, the risks of immediate operation must be contrasted with the risks of subsequent degenerations and complications which, in general, would cause death in about 30 per cent. of the cases. Especially it should be considered that sarcoma develops in 2 and carcinoma in 2.8 per cent.; necrosis occurs in 5, and cystic degeneration in 2.5 per cent., not to speak of the less dangerous complications. The risks of immediate or of early operation in uncomplicated cases of fibroid tumor are very small, probably not more than 1 per cent., as will be shown later (see Prognosis). In addition, the patient escapes the risks of semi-invalidism or invalidism. As has been indicated in the consideration of the pathology of fibroid tumors, early operation in uncomplicated cases would prevent many of the dangers which arise in the later history of these tumors, such as: hemorrhage; anemia; pressure upon the bladder and ureters, with resultant cystitis, hydronephrosis, and degeneration of the kidneys; cardio-vascular degenerations, including brown atrophy, fatty degeneration, and other organic diseases of the heart; and the changes in the blood-vessels and blood which lead to the development of thrombosis and embolism; also the results of pressure upon the bowel, with its secondary consequences. And, in addition, it saves long years of invalidism or semi-invalidism, enabling women to fulfil the duties which devolve upon them, instead of having their activities limited in the effort to reduce their symptoms to a minimum and to prevent accidents to the tumor.

It is the opinion of the author that fibroid tumors should be removed for the same reason that ovarian tumors are removed, the indication differing in degree but not in kind. The early removal of ovarian tumors is practised to guard the patient against the known risks of delay in these growths. The same rule should be applied to fibroid tumors. The nature of the indication is quite similar to that for operation for parovarian cyst, hydrosalpinx, salpingitis in its quiescent stage, Graafian follicle cyst, corpus luteum cyst, or the removal of the vermiform appendix in the interval between attacks of appendicitis. A fibroid tumor is more dangerous to life than any of these morbid conditions. The general rule in surgery, that tumors should be removed, is just as applicable to fibroid tumors of the uterus as to tumors in other regions; and this rule of practice should be based upon the life-history of the tumor rather than upon the particular symptoms which are present when a patient comes under observation. Maurice Richardson states an important truth when he says: "Whenever we postpone operation on fibroid tumors, no matter how benign these tumors may seem, we are running a risk beside which the dangers of an operation are but trivial."¹

This summary of the indications for operation differs from that which has

¹Richardson, Maurice H.: "Uterine Fibroids," *Boston Med. and Surg. Jour.*, 1904, vol. cl, No. 2, p. 39.

heretofore been accepted more in appearance than in fact. This rule was that fibroid tumors which are producing symptoms or which are growing rapidly, also those which are causing mental distress on the part of the patient, should be removed. This indication is broad enough to cover the removal of almost all fibroid tumors coming under the observation of the surgeon, as those patients who have tumors which are small and producing no symptoms do not seek medical advice. The type of tumor in which the advisability of operation is least certain is that in which the tumor is small in size and subperitoneal in development. In this class of cases it is still my practice to advise expectant treatment, although this is done with considerable doubt as to its wisdom.

Contraindications to Operation.—The contraindications to operation in fibroid tumor of the uterus are identical with those of any severe surgical procedure. Before deciding upon operation in cases of fibroid tumor, however, there is a special necessity to thoroughly examine the heart, and to investigate carefully the condition of the blood. Also it must be remembered that the circulatory dyscrasia may persist in spite of treatment until the tumor is removed, and that operation is often successful (where there is careful pre-operative and post-operative treatment) even in the most extreme cases and is followed by speedy recovery.

The youth of the patient and a desire to bear children are proper grounds for the postponement of operation, when fibroid tumors are producing comparatively few symptoms. When permissible in the particular case, myomectomy is preferable to delay, as it both permits of child-bearing and relieves the patient of her malady. Sterility is so frequently associated with fibroid tumor that this fact must be considered when there is thought of postponing the operation. The age of the patient is at times a proper contraindication to operation. Fibroid tumors in the aged and feeble which have not undergone degeneration and which are causing but little trouble should not be operated upon.

The location of the tumor has also a bearing upon the necessity for operation. Submucous fibroids almost invariably produce hemorrhages and are prone to become necrotic, and therefore demand removal even in feeble patients; subserous fibroids, when small, are the least apt to produce grave symptoms or to undergo degenerative changes. Hence, in a patient whose general condition is such as to make an operation hazardous, operation may be demanded for a submucous fibroid and contraindicated for one that is small and subserous in its location.

Choice of Operation.—Both hysteromyomectomy and myomectomy are operations which have distinctive advantages and disadvantages. The choice of operation in the particular case must depend upon a number of circumstances and upon facts directly relating to the individual patient and to the operation itself.

The position and number of the tumors may be such that one or the other of these operations is positively called for, and the choice between them is self-evident. The age of the patient, to a great degree, influences the selection. Myomectomy, except in very simple cases, is more difficult and dangerous than hysteromyomectomy. It requires perfect asepsis and a good operative technic, and unless these conditions

obtain it is always a more dangerous operation than hysteromyomectomy. The attitude of the patient toward child-bearing must influence the choice, for hysteromyomectomy forever precludes the possibility of child-birth, whereas myomectomy may remove the cause, in a given case, of sterility. Single pedunculated subperitoneal or submucous tumors are favorable cases for myomectomy. In all other cases there are various facts to be weighed.

Position and Number of the Tumors.—The object of the conservative operation is to leave the patient with her generative organs capable of child-bearing. If the position and number of the myomata are such that myomectomy would leave behind a mutilated, distorted organ, then the operation would fail of its purpose. Other dangers are inherent in myomectomy, if the tumors are numerous or if they are unfavorably situated. The greater the number of incisions which are made in the uterine muscle, the greater is the number of sutures required to close the areas from which the growths have been enucleated, and the greater is the danger of hemorrhage and of infection. Hence another element is forced into the question—*i. e.*, the immediate mortality of the operation. The situation of the growth favors myomectomy or the reverse. It is unadvisable to perform abdominal myomectomy for tumors which encroach upon the endometrium. While the endometrium may be sterile, it is impossible to determine this in a given case.

Myomata of the submucous variety, if amenable to myomectomy, should be approached by the vaginal route. But unless the tumor is of moderate size and easily exposed by splitting the cervix or by performing anterior hysterotomy, myomectomy should not be attempted. Vaginal myomectomy, with or without hysterotomy, or morcellation of the tumor, is the operation of choice for necrotic or septic submucous fibroids.

The size of a sessile or of an intramural tumor also influences the decision for or against myomectomy. Certainly if the tumor exceeds 10 centimeters in diameter, unless it is single and there is not much distortion of the uterus, it is unsuitable for myomectomy because of the dangers of hemorrhage and of infection, and because in case of pregnancy afterward, the scar tissue in the uterine wall might prove a source of danger.

Age of the Patient.—This is an important consideration in deciding between myomectomy and hysteromyomectomy. The possibility of child-bearing is desirable for every woman until she has passed the greater part of her menstrual life. Hysteromyomectomy in early life brings on an artificial menopause, and with it in certain women a train of distressing nervous symptoms.

Hence the special field for myomectomy is in women under thirty-five years of age, when the other conditions present render myomectomy feasible or permissible. The author believes that the frequency and the gravity of the symptoms of the artificial menopause are overestimated. The percentage of women is small in whom the artificial menopause following hysteromyomectomy is especially troublesome. Whatever the advantages which may accrue to the patient from the conservation of the ovaries in connection with hysteromyomectomy, the best field for the procedure is

in women under thirty-five. When a woman has passed the prime of menstrual life, thirty-five years, it is advisable to perform hysteromyomectomy with bilateral salpingo-oöphorectomy. The variation in the technic of hysteromyomectomy in which at least one ovary is left *in situ* is based upon the theory that the ovary manufactures a substance called the "internal secretion of the ovary," which is absorbed into the system and prevents or delays the onset of the artificial menopause. The theory is as yet not proved, and the number of recorded observations is so small that legitimate deductions cannot be drawn at this time. In the author's limited experience, the retention of one ovary has not modified the post-operative menopause. The risks of subsequent discomfort or invalidism from inflammation or adhesions of the ovary, and the risk of the subsequent development of an ovarian cystoma, are sufficient to make it unwise to leave an ovary except in young and neurotic women, unless the theory as to the internal secretion of the ovary shall be demonstrated. The only exception to this rule is in cases of single pedunculated submucous or subserous tumors.

The Results of Myomectomy and Hysteromyomectomy Compared.—

Mortality.—Myomectomy is a more dangerous operation than hysteromyomectomy, as is generally admitted and as the following statistics show. Winter¹ reports a series of 451 cases of abdominal myomectomy for subserous and interstitial growths, taken from the statistics of Hofmeier, v. Rosthorn, Martin, Olshausen, Schauta, Zweifel, and others, in which there was a mortality of 9.8 per cent. as contrasted with a mortality of 4.8 per cent. for supravaginal hysteromyomectomy. Kelly reports a mortality of 4.5 per cent. in 306 myomectomies, as contrasted with a mortality of 3.1 per cent. in 691 cases of hysteromyomectomy (private communication).

Recurrence.—Myomectomy may be followed by a recurrence, or rather by the further growth of small tumors unnoticed at the time of operation. There is, of course, no recurrence after the radical operation. In 78 cases of subserous and subserous interstitial tumors removed by myomectomy by Engström and Winter (*loc. cit.*), in all of which either celiotomy or colpotomy was performed, and an opportunity was afforded to examine the uterus carefully, there were 6.4 per cent. of recurrences. If submucous tumors be included, there were 8 per cent. of recurrences. In the author's experience, embracing 66 cases, no recurrences are known.

The Frequency of Pregnancy Subsequent to Myomectomy.—Winter (*loc. cit.*), from cases he has followed subsequent to operation, excluding those over forty years of age, and those in whom, because of their social condition, there was no probability of impregnation, found the following:

In 18 cases of myomectomy for submucous myomata, 4 conceptions (22 per cent.).

In 5 cases of pedunculated subserous fibroids, 1 conception (20 per cent.).

In 5 cases of subserous interstitial growths, 1 conception (20 per cent.).

In 37 cases of pregnancy following myomectomy, 26 (72.97 per cent.) went to term.

¹Winter, G.: "Die wissenschaftlichen Grundlagen der konservativen Myomoperation," Zeitschr. f. Geburtsh. u. Gynäk., Bd. li, 1904, S. 105.

In 46 labors following this operation 6 were abnormal, and only one case of dystocia could be attributed to the operation. In the author's experience, in 44 vaginal myomectomies there was one pregnancy with delivery at full term; in 22 abdominal myomectomies there were two pregnancies, with one delivery at term and one miscarriage.

The Relief of Symptoms.—Of 200 cases of radical operation (hysteromyomectomy) collected by Abel, Burkhardt, and Schenk (quoted by Winter, *loc. cit.*), in 94 per cent. the symptoms were fully relieved. In comparison: In 69 cases of myomectomy for submucous tumors, 27.5 per cent. were not relieved. In 16 cases of subserous pedunculated growths, a recurrence of symptoms was noted in 37.5 per cent. In 11 cases of subserous interstitial tumors 45 per cent. continued to suffer (Winter).

Winter found 73 per cent. of myomectomy cases cured symptomatically, while 97.3 were cured after radical operation.

Winter drew the following conclusions:

1. Myomectomy preserves menstruation.
2. Myomectomy makes possible subsequent pregnancy in women under forty years of age. This most often occurs after the removal of submucous and subserous growths. It is very unlikely to occur after the enucleation of subserous interstitial growths larger than a child's head. The pregnancy goes on to term and the labor is easy if the genitalia are otherwise sound.
3. Myomectomy guards against the symptoms of the artificial menopause, which occur in 12 per cent. of radical operations.
4. Myomectomy, even if every visible and palpable tumor is removed, does not guard absolutely against recurrence. When a secondary radical operation is required, the conservative operation must be looked upon as a failure.
5. Myomectomy does not surely relieve the suffering of the patient.
6. Myomectomy by the vaginal as well as by the abdominal route gives worse immediate results than the radical operation.

The following are reasonable conclusions as to the choice of operation from the evidence now in our possession.

1. Pedunculated submucous and pedunculated subperitoneal tumors should be treated by myomectomy.
2. Fibroid tumors undergoing sarcomatous degeneration or complicated by carcinoma of either the corpus or the cervix uteri should be treated by total hysterectomy.
3. Necrotic submucous fibroids should be treated by vaginal myomectomy.
4. When multiple fibroids of the uterus are complicated by a submucous fibroid undergoing necrosis due to the efforts of the uterus to expel it into the vagina, the sloughing fibroid should be removed by vaginal myomectomy. Whether hysterectomy should be done at the same sitting depends upon the condition of the patient. Usually it is best to postpone it.
5. In all other cases the choice of operation must depend upon the peculiarities of the particular case.

Myomectomy has an individual and additional advantage, especially for a young and childless woman. In particular cases the choice of myomectomy profoundly influences the woman's subsequent life; in others, absolutely nothing is gained for the patient. The youthful patient should have the facts explained to her and she should decide whether she will run additional risks for the sake of the possibility of child-bearing.

The choice between supravaginal amputation of the uterus and panhysterectomy in all cases uncomplicated by malignant disease is governed in part by the condition of the cervix and in part by the individual views of the operator. If the cervix is diseased, panhysterectomy is indicated. In cases in which vaginal drainage is indicated, the removal of the cervix gives the necessary opening for drainage. In the remaining cases the personal experience of the surgeon has much to do with the choice of operation, each method having its adherents who believe it to be superior to the other. It is my opinion that supravaginal amputation of the uterus is a safer operation than total hysterectomy, because it can be done more quickly, there is less trouble from oozing, and it does not open the vagina and expose the patient to the possibility of infection from this source. For these reasons, in all cases in which there is no positive indication for the removal of the cervix, the author prefers supravaginal amputation.

The only positive argument in favor of total hysterectomy is that in a small number of cases cancer has developed in the cervix after supravaginal amputation. The small number of cases in which cancer has developed in the cervix as compared with the immense number of hysterectomies which have been performed proves that this danger is so remote that it is far more than overbalanced by the greater safety of supravaginal amputation.

The Relative Frequency of Operations for Fibroid.—Of 337 operations performed by the author for fibroid tumor, there were:

Abdominal supravaginal hysterectomies.....	235
Abdominal panhysterectomies.....	14
Abdominal myomectomies.....	22
Removal of ovaries, etc.....	15
Celiotomies.....	286
Vaginal hysterectomies.....	7
Vaginal myomectomies.....	44
Total.....	337

Thus there were 66 myomectomies as compared with 256 hysterectomies. Of the myomectomies, 22 were performed by the abdominal and 44 by the vaginal route. The latter were either submucous fibroids or fibroid polyps. As a result of this experience, with a similar group of cases to deal with I should not be inclined to vary the relation, except that the number of vaginal myomectomies would probably be somewhat increased. Abdominal myomectomy was performed in less than 8 per cent. of the cases. This experience is in striking contrast to that of Kelly, who has performed 306 abdominal myomectomies and 691 hysteromyomectomies, a percentage of myomectomy about four times greater than in my own experience.

Fifteen cases are recorded as removal of ovaries, etc. These operations were done before the present technic of hysterectomy was perfected, and were made up of removal of the ovaries, attempts at removal, and abandoned operations. The removal of the ovaries for fibroid tumor possesses an historical but no longer a practical interest.

Preparation of the Patient for Operation.—This is the same as for other abdominal operations, but because fibroid tumors frequently produce constipation and vesical disturbance it is advisable before operation to take especial pains to evacuate the bowels thoroughly and to guard against any distention of the bladder. If cystitis is present it should be controlled as far as possible before operation. In many cases the condition cannot be cured until the tumor is removed.

When the patient is very anemic palliative measures should be adopted to control hemorrhage and the general condition and nutrition of the patient should be improved. This is best done by keeping the patient quiet in bed, by careful feeding and the prudent administration of iron, and the temporary use of the vaginal tamponade when required. If the hemorrhage depends upon a submucous pedunculated myoma and cannot be controlled, an immediate vaginal myomectomy is indicated.

In cases of interstitial or submucous tumors not encroaching on the uterine interior, excessive hemorrhage usually can be controlled temporarily by curetage and the introduction of an intrauterine gauze pack. When a submucous tumor encroaches on the endometrial cavity, packing alone should be employed. Curetage in such a case is dangerous, as by injury of its capsule it may seriously interfere with the nutrition of the growth and lead to necrosis. Aside from this danger, curetage is useless in cases of submucous fibroid in which the endometrial cavity is distorted, because it is impossible to curet more than a part of the endometrium. Because it is only palliative, and also because of the risk of injury to and necrosis of the tumor, curetage should seldom be employed in the treatment of fibroids.

For several days previous to the operation, in order to prevent infection of the endometrium, digital or instrumental examination of any sort should not be made unless it is done with full aseptic precautions.

OPERATION.

ABDOMINAL MYOMECTOMY.

The technic of this operation depends upon whether the tumor is pedunculated or sessile. Preparatory to every abdominal myomectomy, and, as will be noted hereafter, before every hysteromyomectomy, it is a good plan to curet and irrigate the interior of the uterus as a part of the disinfection of the operative field. There are cases in which the surgeon will turn from myomectomy to hysteromyomectomy after the abdomen is opened. There are others in which the endometrial cavity will be opened unintentionally during a myomectomy. In both instances it adds to the surety of the technic if all redundant mucosa has been scraped away and if any

discharges or septic blood-clots that were present inside the uterus have been entirely removed from the operative field.

After opening the peritoneal cavity by the usual median incision, the field of operation is isolated by means of gauze pads, which cover the intestines well, and isolate the pelvis from the abdominal cavity. Each side of the incision should be covered with gauze to prevent the uterus from coming in contact with the skin. The myomatous uterus is then delivered through the wound.

Pedunculated Fibroid.—When the tumor is pedunculated a circular incision



FIG. 325.—MYOMECTOMY; TUMOR EXPOSED.

at the root of its pedicle will be all that is required for its enucleation. The flaps of the pedicle wound are then approximated by a row of fine interrupted catgut sutures. If suitable, a deep and a superficial layer may be used. The superficial sutures, whether they be used alone or in combination with a deep layer, should be passed in such a way that they very slightly invert the serous surface of the margins of the wound. By this plan, which is an adaptation of the Lembert intestinal suture, no vestige of raw surface is left to invite adhesions.

Sessile Fibroid.—When the tumors are sessile the technic is more complicated. If a number of tumors are to be removed, the operation should be planned so that as few incisions as possible are made in the uterine muscle and also that they run in the same direction. In this way the mutilation and distortion of the uterus will be reduced to a minimum. An assistant should grasp the supravaginal cervix between the first finger and thumb of the left hand and maintain pressure on the uterine arteries. The ovarian vessels also may be controlled by direct pressure if necessary. A clean incision is made directly through the muscle overlying the tumor (Fig. 325). All bleeding vessels are caught and tied with fine catgut. One of two plans may now be employed for shelling out the tumor. By the first method the surgeon, after exposing the tumor, grasps it with museau forceps and pulls it upward. The surrounding musculature is then pushed away by means of a myoma enucleator (Fig. 326) or other suitable instrument and the tumor is delivered from its bed. Occasionally the use of scissors will be necessary. By the second method, the original incision is continued entirely through the tumor—splitting it in half. Each of these halves is seized and drawn upon with a museau forceps and is separated from its bed by pushing away the surrounding tissue by means of a myoma enucleator or other suitable instrument. The section of



FIG. 326.—KELLY-CULLEN ENUCLEATOR.

the tumor is facilitated by dragging the successive portions of the growth upward and to one side: this enables the operator to keep the depths of the incision in sight and to define the extent of the growth. Fibroid tumors vary considerably in the ease with which they can be enucleated. For simple cases the first method will suffice. In difficult ones, especially when the tumor is impacted in the pelvis, the second undoubtedly has advantages. It is to be stated emphatically that myomectomy is totally unsuitable for fibroid growths which are infected or degenerated. This is also true when salpingitis is or has been present. If during myomectomy such conditions are recognized for the first time, hysteromyomectomy should at once be substituted. After enucleating the fibroid with as little mutilation of the uterine tissue as possible, it is necessary to obliterate the cavity made in the uterine muscle by the removal of the tumor, and to stop all hemorrhage. The larger bleeding points are secured with fine catgut sutures. The cavity of the tumor is obliterated by sutures of catgut, passed in tiers, beginning at the bottom of the cavity (Fig. 327). These sutures may be either interrupted or continuous. Absolute hemostasis is required, otherwise blood will collect within the operative area and there will be great danger of infection. The outermost tier of sutures including the serous surface of the uterus should be so passed that when tied the serous

margins of the incision are slightly inverted so that no raw surface is left to which adhesions might form (Fig. 328).

In all myomectomy operations it is advantageous to use a round needle without a cutting-edge. This produces less hemorrhage than a cutting needle. To the same end, the catgut sutures used for obliteration of the myoma bed should be of such a diameter that they will snugly fit the path of the needle.



FIG. 327.—SHOWING TUMOR ENUCLEATED AND BURIED SUTURES INTRODUCED READY FOR TYING.
a, Deep sutures; b, superficial sutures.

Absolute hemostasis is always possible if a round needle and a continuous suture are employed. Although by a continuous suture strangulation of tissue may occur if the suture is drawn too tightly, a little care will secure snug approximation, good hemostasis, and will avoid strangulation. Mattress sutures occasionally are serviceable to approximate the serous surfaces when there is an especial tendency to hemorrhage. Before closing the margins of the incision ragged edges should be smoothed off, so that accurate approximation is possible. Ligation of the main

arterial supply has been suggested for the purpose of assisting hemostasis in myomectomy. In some instances this may be required, when the sutures introduced to obliterate the cavity fail to control all oozing.

Asepsis in myomectomy must be very strictly observed. The surgeon must invariably wear rubber gloves; the parts should be handled with instruments instead of the fingers, if that is feasible; the uterus must not come in contact with the skin, but must be surrounded and protected from possible contamination by means of gauze; hemostasis and the toilet of the peritoneal cavity should be painstaking to the last degree. Myomectomy should never be attempted amid surroundings which do not permit of these conditions.

HYSTEROMYOMECTOMY. SUPRAVAGINAL AMPUTATION OF THE UTERUS.

As a preliminary step to hysteromyomectomy the vagina should be thoroughly disinfected and the endometrial cavity curetted and irrigated. This reduces to a minimum the danger of septic infection from pathogenic organisms that may have found lodgment in the genital canal; it should be a part of the operation whether supravaginal or a complete hysteromyomectomy is contemplated.

Furthermore, the condition of the endometrium ascertained by such a procedure may have an important bearing upon the choice of operation. For if by curetage



FIG. 328.—SHOWING SUPERFICIAL ROW OF SUTURES INTRODUCED AND TIED.



FIG. 329.—KELLY'S PICK; PRONGED INSTRUMENT.

malignant changes are discovered or strongly suspected, complete hysterectomy is indicated. Except in such a case or in one suspected of sarcomatous degeneration supravaginal hysteromyomectomy is the preferable operation. The routine disinfection of the vagina has other advantages. It permits a final examination

under anesthesia and thus facilitates more exact diagnosis. It leaves the vagina aseptic, so that if vaginal drainage must be employed the vagina is already prepared.

The steps of the operation in supravaginal hysteromyomectomy are as follows:

1. *Incision.*—The abdomen is opened through the right rectus muscle, near but not through the linea alba. The incision should be long enough to facilitate the delivery of the tumor.

2. *Isolation of the Field of Operation.*—The intestines are carefully covered with gauze pads, special care being taken to pack off the false pelvis on each side. If the gauze pads are well placed, the intestines do not come into view during the operation.

3. *Separation of Adhesions and Delivery of the Tumor.*—Usually the tumor is best delivered by means of the hand. If necessary, it may be grasped with a heavy volsellum forceps, which is much superior to the corkscrew. Adhesions are relatively uncommon, and when present are usually due to infection of the uterine appendage. Occasionally it is necessary to ligate and divide the upper part of the broad ligaments before delivering the tumor.

4. *Ligation of the Broad Ligaments.*—(a) The upper border of the broad ligament on one side is ligated external to the ovary. Catgut is used and the suture embraces only enough tissue to secure the ovarian vessels.

(b) One of the free ends of the first ligature is carried around this pedicle and beneath the round ligament; the ligature is then again tied. By such a disposition the ligature is securely anchored, the summit of the broad ligament is narrowed, and the area of the pedicle is reduced to a minimum.

(c) A clamp is placed toward the uterine end of the broad ligament to control reflux hemorrhage, and the upper border of the broad ligament, including the round ligament, is divided between the ligatures and the clamp.

(d) The peritoneum on the anterior face of the broad ligaments and in front of the uterus is divided, the incision extending from one round ligament to the other, and the vesical peritoneum is then pushed down with a sponge. Traction is made upon the tumor, which is rolled over to the opposite side, and the uterine vessels are exposed by pushing away the broad ligament from the tumor or the uterus with a sponge.

(e) The cervix is located and a ligature is then placed low down on the cervix to secure the uterine artery in its course along the uterine wall. The ligature is best placed with a sharp needle and carrier, which has manifest advantages for this purpose over the ordinary aneurism needle. The ligature which controls the uterine artery should be passed through the external border of the cervix, but should include little tissue in its grasp. The uterine artery is seized, cut above the forceps, and the artery again tied, using the long ends of the first ligature for this purpose. By means of this technic both the ovarian and the uterine arteries are tied twice with the same ligature, which effectually guards against secondary hemorrhage through the loosening of the knot of the catgut ligature.

(f) The same steps are then carried out upon the opposite side.

5. *Section of the Cervix.*—The cervix is divided below the level of the internal os, an effort being made to slightly cup the stump, which facilitates its subsequent suturing.

6. *Closure of the Cervical Stump.*—The cervix is closed with a continuous or with a few interrupted catgut sutures (Fig. 331).

7. *Hemostasis.*—Should oozing vessels be found (which is unusual), they may be controlled by fine catgut ligatures.

8. *Retroperitoneal Treatment of the Cervical Stump.*—The peritoneum from the bladder and that from the front of the broad ligaments is stitched over the open broad ligaments and the cervical stump with a continuous Lembert catgut suture;



FIG. 330.—SHOWING THE PELVIS WITH TUMOR, UTERUS, AND APPENDAGES REMOVED.

the upper borders of the broad ligaments (ovarian and round ligament stumps) are buried under the peritoneal flap if it proves convenient (Fig. 331). When there is a tendency for the cervix to prolapse, the upper border of each broad ligament together with the round ligament may be sutured to the cervix before covering the stump with the peritoneal flap. The suture is introduced so as to draw the peritoneal flap snugly over the stump, in this way avoiding the formation of a dead space.

9. *Toilet of the Pelvis.*—The pelvis is sponged clean with gauze moistened in normal salt solution. It is well also to wash the stump of the cervix in the same manner before covering it with the peritoneal flap.

10. *Closure of the Abdomen.*—After removing the gauze the abdomen is closed.

Kelly's Technic for Hysteromyomectomy.¹—Kelly has devised a technic which is applicable to all cases, but especially to intraligamentous fibroids (Fig. 332). He ligates the broad ligament on one side and separates the vesical peritoneum as already described. After tying the corresponding uterine artery "the cervix is cut completely across just above the vaginal vault, severing the body of the uterus from the cervical stump, which is left below to close the vault. As the last fibers of the cervix are severed or pulled apart, while the body of the uterus is being drawn up and rolled out in the opposite direction, the other uterine artery comes into view and is caught with an artery forceps, about an inch above the cervical stump. Rolling the uterine body still further out, the round ligament is clamped

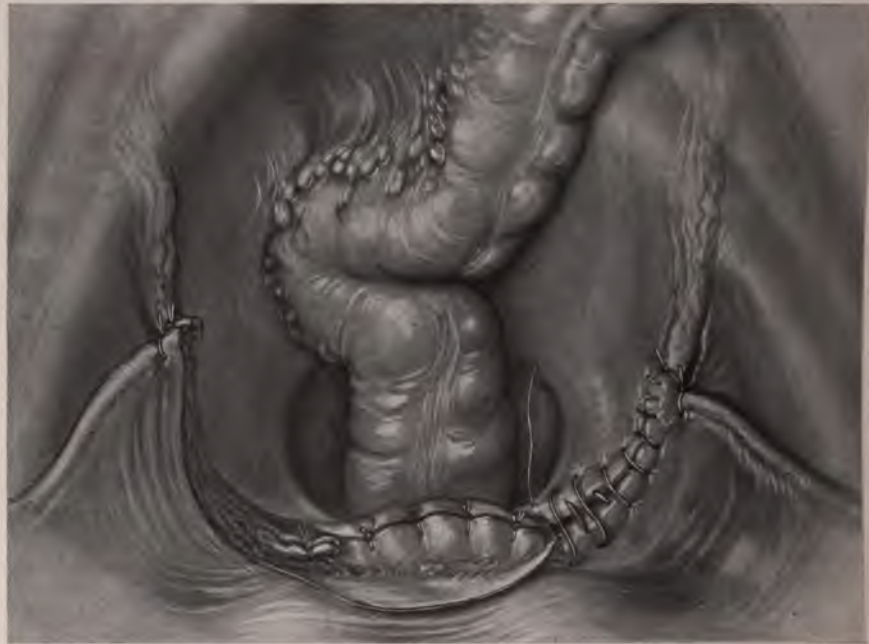


FIG. 331.—SHOWING THE STUMP SUTURED AND THE CLOSURE OF THE PERITONEUM OVER THE STUMP BEGUN.

at the pelvic brim, and the removal of the whole mass, consisting of uterus, tubes, and ovaries, is completed."

The remaining steps of the operation do not differ from that already described.

TOTAL HYSTERECTOMY.

The simplest technic for total hysterectomy for those in the habit of performing supravaginal amputation of the cervix is to divide the operation into two stages: First to remove the tumor and uterus at or below the level of the internal os;

¹ Kelly, H. A.: "Hysteromyomectomy and Hysterosalpingo-oophorectomy by Continuous Incision from Left to Right or from Right to Left," Johns Hopkins Hosp. Bul., 1896, vol. vii, Nos. 59 and 60, p. 27.

second, to remove the cervix. The technic of the supravaginal amputation does not differ from that already given, except that the ligature for the uterine vessels should be passed by means of a blunt aneurism needle, so that it does not encroach upon cervical tissue.

The removal of the cervix may be effected in either of two ways:

1. Each lateral half of the cervix is grasped with volsellum forceps, and the cervix is split antero-posteriorly down to and through the external os. In this way the vagina is opened, using the cervical canal as a guide. The parametria at each side of the cervix may be ligated from above downward and the cervix cut away, or the

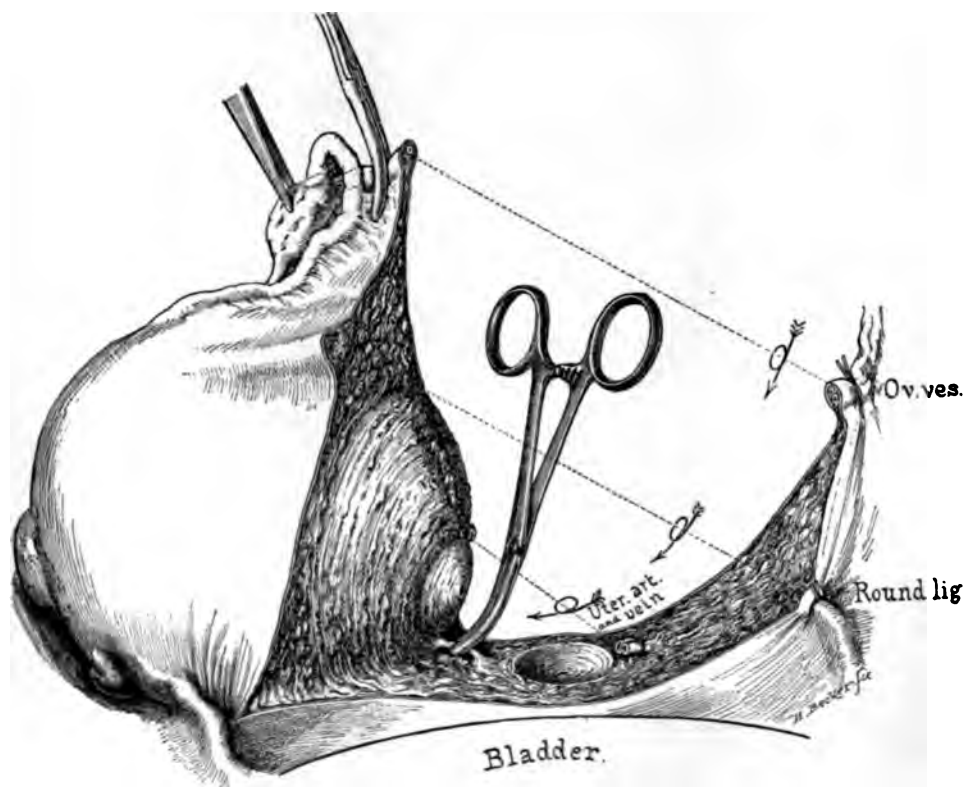


FIG. 332.—SHOWING THE KELLY TECHNIC LEFT TO RIGHT (Kelly).

principle used in Doyen's operation may be employed by catching each half of the vaginal portion of the cervix with a strong volsellum and drawing it up into the peritoneal cavity, thus making tension upon the vaginal and parametrial connections of the cervix. The vagina is then clipped through with scissors close to the cervix, and the broad ligament is in turn detached from the cervix. Bleeding or oozing vessels may be caught with forceps and ligated. Bleeding from the cut vaginal edges is controlled by mattress sutures or by ligatures.

2. The cervix is caught with volsellum forceps and drawn to one side of the pelvis.

The bladder is carefully pushed off the front of the cervix and anterior wall of the vagina. As a preliminary to dividing the broad ligaments at the sides of the cervix, ligatures should be passed from above downward by means either of a dull aneurism needle or a sharp needle, care being taken to avoid the ureter. As each ligature is tied the corresponding tissues are divided, until the vaginal walls are reached. The

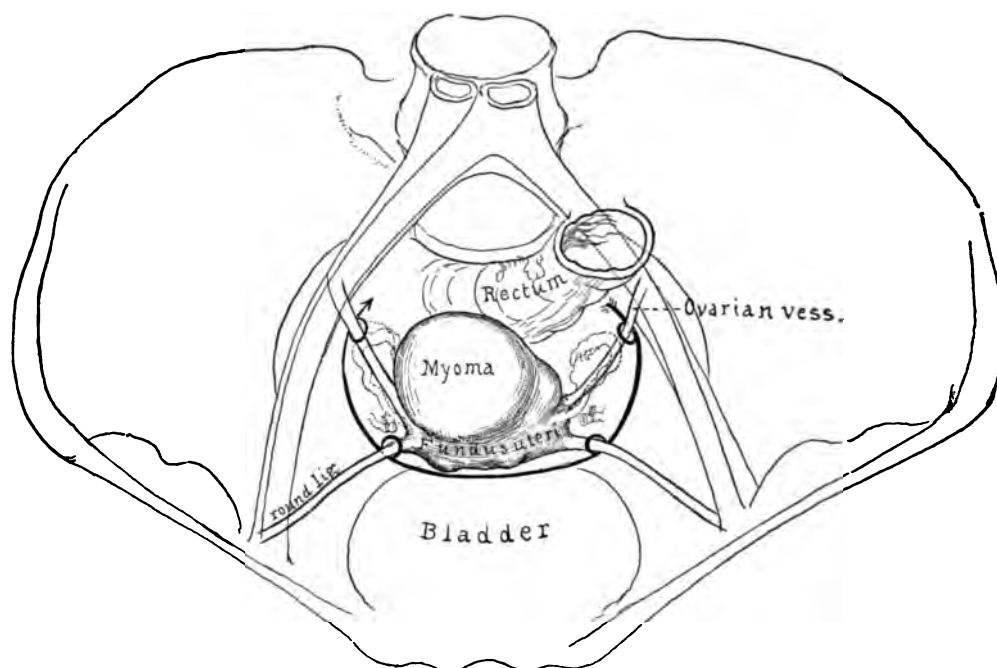


FIG. 333.—SHOWING THE SCHEME FOR LIGATION FOLLOWED IN THE KELLY TECHNIC.



FIG. 334.—EDEBOHL'S ARTERY FORCEPS.
Useful for catching vessels deep in the pelvis.

vagina is best cut through in front of the cervix, when the incision can be extended laterally until the entire cervix is detached. Bleeding from the cut vaginal wall is controlled either by mattress sutures or by ligatures.

When complications do not exist which necessitate drainage of the pelvic cavity, the cut vaginal edges may be sutured with catgut before the field of operation is

covered by suturing the anterior and posterior peritoneal leaflets of the broad ligaments. In this way the field of operation is shut off from the vagina as well as from the peritoneal cavity and primary union under the peritoneal flaps is secured. In certain cases it is better to place a gauze drain in the vagina and to permit the end of it to project between the walls of the vagina into the parametrial space, so as to drain the field of operation. In some cases this is advisable to save time, when feeble patients have become shocked in the course of an operation. In all cases of complete hysterectomy a gauze drain should be placed in the vagina itself.

The field of operation in total hysterectomy should be rendered extraperitoneal by uniting the anterior and posterior folds of the peritoneum as is done in supravaginal amputation of the uterus.

Pryor's Technic for Total Hysterectomy.¹

—The ovarian arteries are ligated at the pelvic brim. The bladder is next dissected away from the cervix down to the vagina until the uterine arteries can be felt. These are now ligated, the ligatures being placed by means of a curved aneurism needle around the vessels. The round ligaments are next ligated a little distance away from the uterus. By means of an incision, which passes down one side, the ovarian vessels, then the round ligament and broad ligament, are severed, then the uterine artery is cut alongside the cervix and the vagina is entered. The uterus is then tilted over to the other side. The incision now passes up through the vagina, broad ligament, round ligament, and ovarian vessels. Smaller vessels, such as branches from the vaginal arteries, may require ligation. By means of this operation the symmetrically enlarged uterus is readily and speedily removed.

Doyen's Panhysterectomy.²—In this operation the myomatous uterus is pulled through the abdominal incision and swung forward and down over the pubes. The poste-

¹ Pryor, Wm. R.: "A New and Rapid Method of Dealing with Intraligamentous Fibromata," *Med. News*, 1894, vol. lxv, p. 602.

² Doyen, E.: "Hysterecтомies Abdominales," *Arch. prov. de Chir.*, T. i, No. 6, Dec., 1892, p. 494.



FIG. 335.—PÉAN'S HYSTERECTOMY FORCEPS.

Useful for grasping the broad ligaments.

rior vaginal fornix is opened through the pouch of Douglas and the cervix is caught with a tenaculum forceps. The cervix is now drawn through the posterior vaginal incision and strong traction is continued while it is cut away from the vaginal walls laterally and in front. The section is made close to the muscle of the uterus to the inner side of the attached structures, which are under considerable tension from the traction upon the cervix. The broad ligaments and uterine vessels are clamped if necessary, and by continuous incision hugging the uterine wall the fibroid uterus is literally skinned out of its attachments. No attention is paid to the adnexa during this procedure, the line of excision passing through the insertion of the tubes and of the round ligaments at the uterine cornua. After the uterus has been



FIG. 336.—SHOWING CURVE OF PÉAN'S HYSTERECTOMY FORCEPS.

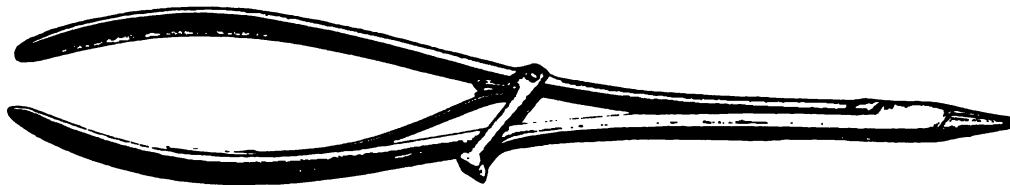


FIG. 337.—LONG NEEDLE-HOLDER FOR SUTURING DEEP IN THE PELVIS.

removed, the adnexa are dealt with as desired and the operation is completed by sewing up the vaginal wound and uniting the peritoneum over it.

ATYPICAL AND COMPLICATED OPERATIONS.

The descriptions of technic given have applied to uncomplicated or easy cases in which the uterus is freely movable and in which these procedures may be systematically carried out. There are a number of complications, however, which may render hysteromyomectomy an exceedingly difficult operation. The surgeon's first act after opening the abdomen should be to examine thoroughly the pelvic and lower abdominal cavities. Upon the conditions present will depend the choice of technic for the operation. If inflammatory or other disease of the adnexa is present, the effort should be made to reduce the complicated to a simple case by breaking up the adhesions of the tubes and ovaries. By freeing these structures the hysteromyomectomy becomes a typical or an uncomplicated one. If cystic enlargements or actual cysts of the ovary are present, the tumors should be freed and,

if not too large, removed with the uterus. However, if the ovarian tumor is large, it will facilitate matters to remove it first, after tapping it if necessary, and then to proceed with the hysteromyomectomy. Adhesions to the intestines and to the omentum are dealt with on general surgical principles. The first effort of the surgeon should be to free the tumor, the uterus, and the appendages. Then the tumor, etc., can be delivered and the technic chosen just as in an uncomplicated case. Those hysteromyomectomies are difficult in which, because of the density of the adhesions or from the position and the size of the tumors, the uterus is fixed deeply in the pelvis and the landmarks are obscured. Hemorrhage is the great danger in such a case and, in addition, important viscera may be injured. A start in the enucleation of the tumor can almost invariably be gained by tearing into the cellular tissue of the broad ligaments at the side of the uterus and pushing the cellular tissue away from the tumor until it is partly freed and a more usual technic can be employed. This can also be done in certain cases with advantage by cutting directly through the summit of the ligament on the one or the other side of the fundus uteri. Instead of ligating the ovarian artery at the usual point, in such cases it is tied at the median side of the ovary. After tying the round ligament an artery forceps or a ligature is placed at the cornu of the uterus to include the utero-ovarian anastomosis and the vessels of the round ligament. An incision can now be made directly through the tube, mesosalpinx, and round ligament into the broad ligament. Thus an intraligamentous fibroid may be peeled out of the broad ligament, or a densely adherent adnexal mass may be separated from beneath.

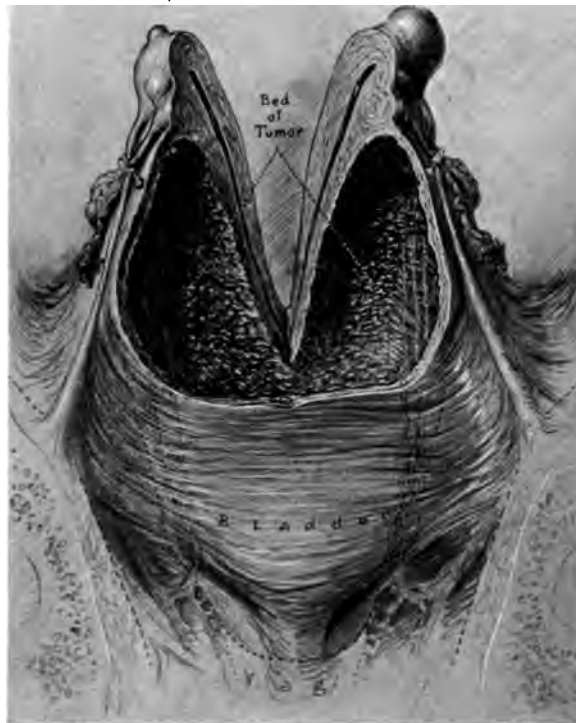


FIG. 338.—METHOD OF SPLITTING THE FIBROID TUMOR OR SPLITTING THE UTERUS IN IMPACTED FIBROID TUMORS (Kelly).

In the case of a densely adherent adnexa or of an intraligamentous tumor on one side only, the operation should be performed after Kelly's technic, beginning upon the easy side. After cutting across the cervix, the tumor or the adherent adnexa can be enucleated from below.

When the tumor is firmly impacted in the pelvis, it may resist efforts to pull it upward. Pressure upward through the vagina, made by an assistant, may aid in its delivery. This procedure will very rarely be necessary. When, in difficult cases, from the position of the tumors or inflammatory complication the relations are obscured, the course of the round ligament, which can always be found at the internal ring, is a valuable guide to the fundus uteri.

The position of the bladder is sometimes greatly altered by the growth of the tumor. It may be pushed upward by a tumor developing between the base of the bladder and the anterior vaginal wall. In such cases care must be taken in dividing the vesico-uterine fold of peritoneum, and the incision from round ligament to round ligament in front of the uterus must be made well above the line of reflection. The bladder wall may then be pushed off from the front of the uterus. A gauze sponge will be found useful in pushing off the peritoneum and in enucleating tumors embedded in cellular tissue.

Fibroid tumors developing posterior to the cervix and behind the peritoneum are reached from the front. The cervix is cut through antero-posteriorly, and enucleation is accomplished by peeling out the tumor from below.

Kelly's Modifications for Atypical Cases.—When a myoma originates in the cervix and grows to a considerable size supravaginal hysterectomy is very difficult. The fundus of the uterus is raised out of the pelvis on the vertex of the tumor, and the vascular relations are very much altered. The uterine and occasionally the ovarian vessels are spread fan-like over the broad convexity of the tumor. It is difficult to distinguish one set of vessels from the other. If an attempt is made to do the operation in the usual way all of these branches must be ligated separately. This is nearly impossible without great loss of blood, and without greatly prolonging the time of operation. In certain cases of suppurating fibroids the pus discharges into the bowel and there are extensive intestinal adhesions the separation of which before the blood-supply of the tumor is controlled may be accompanied by much bleeding, and in which cutting through the fistula in the bowel with the tumor still *in situ* renders infection of the peritoneal cavity very probable. These difficulties have been met by Kelly¹ in three ways:

1. By a median sagittal section of the uterus with the tumors.
2. By a bisection of the tumor alone.
3. By a coronal bisection of the uterus in its cervical part.

The first procedure is useful in cases complicated by extensive inflammatory disease of both adnexa, where the inflammatory masses cannot be reached readily behind the tumors and where the tumor masses themselves are anchored to the pelvis by the adhesions (Fig. 338). It is also of great service when from the situation or size of the tumor the ovarian vessels cannot be reached at the beginning of an operation.

Bisection of the tumor alone is applicable to single subperitoneal tumors either in front, under the vesical peritoneum, or to one side in the broad ligament. It is especially valuable when their removal will greatly facilitate the subsequent hyste-

¹Kelly, H. A.: "The Evolution of My Technique in the Treatment of Fibroid Tumors," Am. Journ. Obstet., 1900, vol. xlii, p. 289.

rectomy by giving room for operative manipulation and by permitting access to the blood-supply.

The third method was adopted by Kelly in a case of huge suppurating myoma reaching to the umbilicus and adherent by its upper pole to the bowel, into which the pus was discharging (Fig. 339). In this case he located the cervix behind the symphysis at the vesical reflection. The cervix was pulled up and the vesical

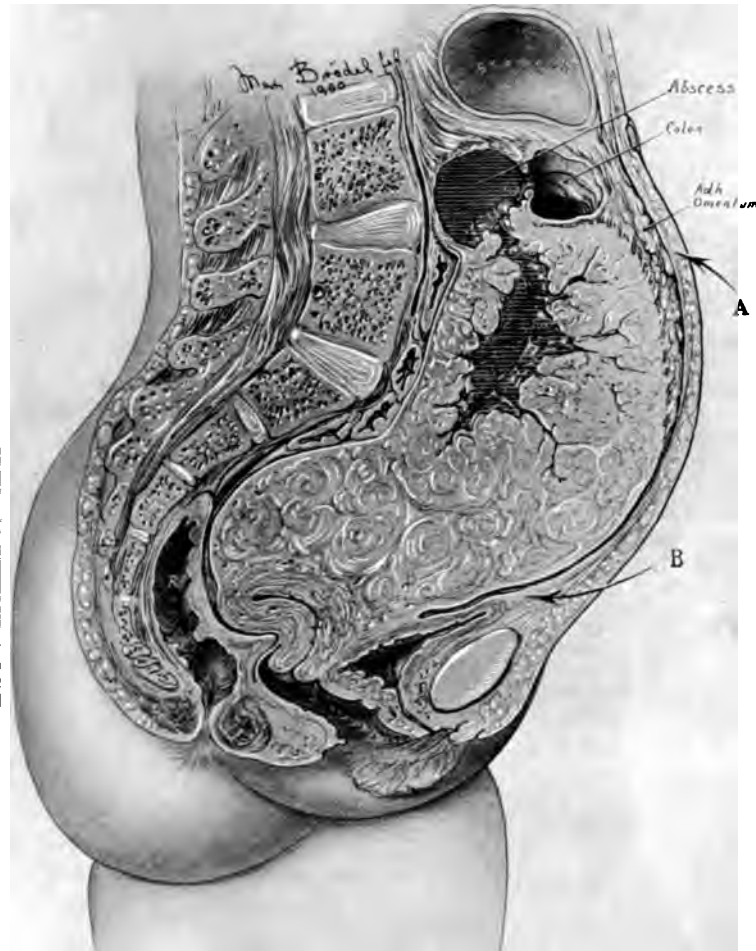


FIG. 339.—SECTION SHOWING SUPPURATING FIBROID DISCHARGING INTO BOWEL (Kelly).

peritoneum detached. The cervix was then cut transversely by plunging a knife through its center and then cautiously dividing it to either side (Fig. 340). The uterine artery on each side was clamped as soon as the outermost fibers of the cervix had been divided. After securing these vessels the cervix was forcibly pulled upward, the broad ligaments detached, and the round ligaments and ovarian vessels were clamped from below and behind. This permitted a much



FIG. 340.—SHOWING SEPARATION OF CERVIX AND UTERUS FROM BROAD LIGAMENT PRELIMINARY TO DETACHING COLON FROM TUMOR IN CASE OF SUPPURATING FIBROID DISCHARGING INTO BOWEL (Kelly).

more orderly detachment and closure of the bowel, with lessened risk of infection and without embarrassment from the presence of the tumor.

Panhysterectomy for Intraligamentous Fibroid by Pryor's Technic.¹—The ovarian vessels and the round ligament on both sides are ligated. The bladder is separated from the uterus in the usual way and pushed downward until the vaginal cervix can be felt through the anterior wall of the vagina. On the free side the broad ligament is now cut and the uterine vessels exposed by blunt dissection. The uterine vessels are ligated and the vagina is cut away from the cervix at the side and in front. The uterus is now forcibly pulled toward the side in



FIG. 341.—SECTION OF LARGE MYOMA WITH BLADDER DRAWN OUT OF PELVIS AND FUNDUS CARRIED UP INTO ABDOMEN.

which the intraligamentary nodule is situated and the cervix is grasped with powerful traction forceps and drawn through the vaginal incision. This renders the intact portion of the vagina tense, and by means of scissors it is entirely cut away from the cervix. This exposes the base of the broad ligament, and the uterine artery is found beneath the intraligamentary nodule. The artery is ligated and cut close to the cervix. It is now an easy matter to peel the fibroid from between

¹ Pryor, Wm. R.: "Gynecology," New York, 1903, p. 252.

the layers of the broad ligament. The ovarian vessels and round ligament upon this side are ligated and the upper portion of the broad ligament is divided, which completes the removal of the uterus and tumor. Although the four cardinal vessels have been secured, lesser arterial trunks as well as veins may require ligation, particularly in the posterior vaginal wall and uterosacral ligaments.

When both sides contain intraligamentary nodules Pryor splits the anterior wall of the uterus from the fundus down through the cervix into the vagina.

One ligamentary nodule is now exposed by cutting from the endometrium through the lateral border of the uterus. It is fixed by means of a corkscrew and enucleated. The posterior wall of the uterus is now completely divided. After ligating the ovarian and the uterine artery this half of the uterus is removed. The same procedure is then carried out upon the other side.

The object of removing the intraligamentary nodules through the severed uterine wall is to produce symmetry upon each side of the pelvis successively, thus allowing the ureter, often displaced over the broad ligament, to recede to its usual situation and thus escape injury.

The Protection of the Ureters During Hysterectomy.—It must be the constant care of the surgeon to protect the ureters from injury in all cases of hysteromyomectomy. The risk of injuring or ligating them is much greater in intraligamentary and cervical fibroids than in those arising from the fundal portion of the uterus and growing into the cavity of the abdomen. When the classic technic is employed in hysterectomy, after the ovarian vessels and the round ligament are ligated and divided (thus opening up the connective tissue of the broad ligament) the ureter is best protected by pushing the broad ligament away from the uterus or tumor. This is especially important when operating for intraligamentary fibroids. If the broad ligament is pushed away from the uterus or from the tumor, the ureter is necessarily pushed aside out of harm's way. In tying the uterine vessels the ligature-carrier should either penetrate the lateral wall of the cervix or be passed immediately at its side. In this way the ureter is guarded against ligation. When the technic of Pryor or Kelly is employed, the same principles apply when dealing with the broad ligament divided from above downward on the easy side. When the opposite broad ligament is detached from below upward, it is possible to catch the ureter with the forceps or ligature in tying the uterine vessels. This accident has happened from failure to observe due precaution at this point in the operation, and the relations of the ureter should be constantly borne in mind when using either the Kelly or the Pryor technic. As a rare condition certain lobules of a fibroid tumor may develop beneath the ureter and others above the ureter, so that the ureter may pass between adjacent fibroid tumors. Under these circumstances nothing but the habit of the surgeon constantly to recognize tissues before he cuts them will protect the ureter from injury.

The Management of Certain Complications.—In the description of Kelly's modifications for operation in atypical cases, the method of dealing with a suppurating fibroid discharging into the bowel has been described.

Necrotic fibroids are usually submucous and should be removed per vaginam whenever possible. When intramural, or subperitoneal, or pedunculated, the same principles apply to hysteromyomectomy that are made use of in dealing with other septic foci within the abdomen. The general peritoneal cavity should be carefully packed off, and every effort should be made to keep the field of operation dry and to prevent soiling or infection of the peritoneum. Unless the integrity of the bowel, bladder, or ureter is open to suspicion, drainage is not indicated if raw surfaces can be covered with peritoneum and all oozing arrested.

Necrotic or infected fibroids complicating labor or the puerperal state form a class apart. If virulent puerperal infection exists and the conditions demand or justify operation, the old method of extraperitoneal treatment of the pedicle by means of the *serre-naud*, or the elastic ligature and transfixion pins, may be indicated in this particular class of cases.

Pyosalpinx, abscess of the ovary, or suppurative pelvic peritonitis complicating fibroids may or may not constitute a serious complication. As a rule, pyosalpinx or abscess of the ovary can be removed along with the tumor and uterus without greatly modifying the technic or increasing the risk of the operation. This applies to the cases in which the pus is old and sterile. The peritoneum should be protected against soiling and raw surfaces should be covered with peritoneum. Under these circumstances drainage is not indicated. Suppurative peritonitis or acute pelvic abscess associated with fibroids forms a serious complication. When an accurate diagnosis can be made, it is far better to treat the pelvic suppuration by vaginal drainage and to postpone a radical operation until the risk of infection can be eliminated. If hysterectomy is performed under these conditions, vaginal drainage should be employed.

Appendicitis is not an infrequent complication of fibroid tumors. When an appendicitis is acute and suppurative, if feasible, the operation should be directed to the appendicitis alone and the tumor should be disregarded. Several times in my experience the tumor has been so large that it was impossible to reach the appendicular abscess until the tumor was first removed. In these cases the tumor was removed through a central incision and the appendix was operated upon through a lateral incision, which permitted proper drainage of the appendicular abscess. Non-suppurative acute appendicitis or chronic appendicitis can be dealt with through the median incision made for the removal of the tumor.

Drainage after Hysteromyomectomy.—The general principles applicable to all pelvic operations with reference to drainage apply to hysteromyomectomy. Drainage is contraindicated in aseptic operations; in operations complicated by pus accumulations in which the pus is sterile, whenever the pus sacs can be removed, the oozing controlled, and the raw surfaces covered by peritoneum.

Drainage is indicated: (1) When the integrity of the bowel, bladder, or ureters is open to suspicion. (2) When suppurative peritonitis exists as a complication. (3) When abscess sacs cannot be completely removed, so that what the older surgeons called a "pyogenic membrane" must be left behind. (4) When it is

not feasible to arrest oozing from extensive raw surfaces, especially after the enucleation of intraligamentary tumors complicated by pelvic exudate. In such cases it is at times better to pack than to take the time necessary to apply a multitude of ligatures.

When drainage is indicated after hysteromyomectomy, except in the rarest instances, vaginal drainage should be employed. The exceptions should be when the bowel has been injured at some point outside the pelvis, when an appendicular abscess exists as a complication, or when there has been an extensive suppurative peritonitis. The vaginal drain may extend through the opening made for complete hysterectomy or an incision may be made behind the cervix into Douglas' cul-de-sac. It is my own practice after covering all possible points with peritoneum to pack the Douglas pouch and cover remaining raw surfaces with roller bandage gauze. After closing the abdominal wound the patient is put in the lithotomy position, the cervix is caught with a volsellum forceps, the posterior wall of the vagina is caught with a second volsellum forceps, the tissues behind the cervix are incised laterally, either with a knife or scissors, and a blunt-pointed Bozeman scissors is forced through the tissues behind the cervix into Douglas' pouch. The roller bandage gauze is then caught with a forceps and drawn into the vagina. To this is tied another piece of roller bandage gauze, and then the opening through the vagina is packed so as to control any tendency to oozing in the fresh wound. The vagina is then filled loosely with gauze. The gauze is removed a part at a time from the second to the fifth day.

The Necessity for the Examination of the Uterus and Tumor Immediately after Hysteromyomectomy.—Sarcomatous degeneration is present in 2 per cent. of fibromyomata; carcinoma of the corpus uteri in 1.8 per cent.; and carcinoma of the cervix uteri in 0.7 per cent. It is frequently impossible to make a diagnosis of sarcoma until after operation, and this is also true in certain cases of carcinoma of the corpus uteri. These facts have been dwelt upon especially by Cullen,¹ Eastman,² and the author.³ At the conclusion of every hysteromyomectomy, especially by supravaginal amputation, the specimen should be cut open and the tumors and endometrium studied. If either sarcoma of the tumor or carcinoma of the endometrium is found, the cervix should then be removed.

The Abdominal Versus the Vaginal Route in Operations for Fibromyomata.—The arguments in favor of the vaginal route will be found in the chapters on vaginal myomectomy and vaginal hysterectomy. Many facts bearing upon the relative advantages of the abdominal or the vaginal route will be found scattered through this chapter. In the opinion of the author the abdominal route presents

¹ Cullen, Thomas S.: "Immediate Examination of Uterine Mucosa and Myomatous Nodules after Hysteromyomectomy to Exclude Malignant Disease," Jour. Amer. Med. Assoc., March 10, 1906, vol. xlv, p. 695.

² Eastman, Thomas B.: "Innocent Fibromyomata of the Uterus," Jour. Amer. Med. Assoc., Oct. 21, 1905, vol. xlv, No. 2, pp. 1238-1243.

³ Noble, Charles P.: "Report of a Case of the Invasion of a Fibromyoma of the Uterus by an Adenocarcinoma, which by Metaplasia had Assumed the Appearance of a Squamous Cell Carcinoma," Amer. Jour. Obstet., 1904, vol. xlix, No. 3, p. 306.

undoubted advantages for the removal of fibroid tumors as a routine, and this method should be adopted unless in the particular case there is some good reason to the contrary. Sloughing fibroid polyps and infected or necrotic submucous fibroids should be removed by vaginal myomectomy. Certain other submucous fibroids and cervical fibroids should also be removed from below, employing hysterotomy if necessary. Small fibroid tumors occurring in fat women with a roomy or fairly roomy vagina are best removed by vaginal hysterectomy.

The Routine Examination of the Uterus and Adnexa after Hysteromyomectomy.—Erroneous views concerning fibroid tumors, their life-history, degenerations, and complications, have persisted until the present day, because specimens removed at operation have not been systematically examined by competent pathologists. If this were done systematically in hospitals, there would soon accumulate such a mass of evidence concerning these questions that our knowledge of the subject would become full and complete.

After-treatment.—The after-treatment of hysteromyomectomy and myomectomy does not differ from that of other abdominal operations. (See page 509.)

Prognosis.—The mortality of operations for fibroid tumors has steadily decreased as surgical technic has improved and as patients have been submitted earlier to operation. Formerly the mortality was 20 or even 30 per cent. Recently Baldy¹ and Deaver² have reported their entire experience with hysteromyomectomy. Baldy reports 250 operations with 21 deaths, or 8.4 per cent. mortality; Deaver 233 abdominal hysterectomies with 21 deaths, or 9 per cent. mortality. Kelly's clinic, Johns Hopkins Hospital (private communication), reports 306 myomectomies with 14 deaths, or 4.5 per cent. mortality; and 691 hysteromyomectomies with 22 deaths, or 3.1 per cent. mortality.

As showing the improvement in results and indicating the mortality of the operation at the present time, the table on page 712, made up of the latest series of operations from the operators mentioned, together with those of Webster (private communication) and Werder,³ and the addition of my own recent operations, is of interest.

The data concerning the mortality of operations could be greatly amplified with a similar result. Additional statistics will be found on page 688. The following estimate of the mortality of operations for fibroid tumors is approximately correct:

For supravaginal hysteromyomectomy in uncomplicated cases, 1 per cent.; for the average of cases as seen at present, from 2 to 4 per cent.; in seriously complicated cases, 10, 20, or 30 per cent.

The mortality of myomectomy when the cases are strictly selected is about 3 per cent.; and when the indication is broader, about 5 per cent. The mortality

¹ Baldy, J. M.: "The Mortality of Operations upon Fibroid Tumors of the Uterus," *Amer. Jour. Obstet.*, Sept., 1905, vol. lii, No. 3, p. 370; Oct., No. 4, p. 560.

² Deaver, John B.: "Hysterectomy for Fibroids of the Uterus," *Amer. Jour. Obstet.*, Dec., 1905, vol. lii, No. 6, p. 858.

³ Werder, X. O.: "A Consideration of the Factors which have Lowered the Operative Mortality and have Improved the Post-operative Results," *Amer. Jour. Obst.*, 1906, vol. liv, p. 736

in the same class of cases treated by hysteromyomectomy would not exceed 1 per cent.

The mortality of total hysterectomy is greater than that of supravaginal amputation; most tables of statistics make the mortality of total hysterectomy nearly double that of supravaginal amputation.

Baldy.....	105 operations.....	3 deaths
Deaver.....	105 supravaginal hysterectomies.....	3 deaths
Johns Hopkins Clinic.....	100 abdominal operations.....	3 deaths
Werder.....	118 abdominal operations.....	1 death
Webster.....	100 abdominal operations.....	3 deaths
Noble ¹	115 operations.....	0 death
Total.....	643	13 (2 per cent. mortality).

The mortality of supravaginal hysteromyomectomy and abdominal myomectomy which has been given is that of these operations when performed by trained gynecologists under the best conditions. These results by no means represent the average of all surgeons. These operations in the hands of the occasional, inexperienced, and untrained surgeon have approximately the same mortality now as was true twenty years ago.

¹ From September 20, 1902, to January 10, 1907, 104 celiotomies, no death.

Abdominal myomectomy.....	10
Abdominal panhysterectomy.....	5
Exploratory celiotomy.....	1
(Operation undertaken with diagnosis of ovarian tumor complicating pregnancy.)	
Supravaginal amputation.....	88
Vaginal myomectomy.....	104 11
Total.....	115 (no death)

CHAPTER XX.

VAGINAL MYOMECTOMY.

BY CHARLES P. NOBLE, M.D.

By vaginal myomectomy is meant the removal of a fibroid tumor or tumors by the vaginal route, with the conservation of the uterus itself. The tumor may be a fibroid polyp, or it may be submucous, intramural, or subperitoneal in its location. A fibroid polyp or a submucous fibroid may be removed through the dilated cervical canal. These and the remaining types of fibroids may require anterior, bilateral, or posterior hysterotomy for their removal. Vaginal celiotomy, anterior or posterior, may be necessary for the removal of subperitoneal fibroids.

Amussat¹ in 1840 performed the first vaginal myomectomy for the removal of a submucous fibroid. He successfully performed two operations for submucous fibroids which were in the early stages of expulsion from the uterus—as in each case the cervical canal was dilated one-half inch or more. In the second case he split the cervix, thus performing the first vaginal hysterotomy. He also proposed to split fibroid tumors which are too large to be removed entire. Amussat's success led his contemporaries to imitate his example, but the fatalities were so great that the operation fell into disuse in France.

Atlee² first performed vaginal myomectomy in 1845. He was the great pioneer in the removal of fibroid tumors both per vaginam and by abdominal section, but most of his operations were done by the vaginal route. He continued to operate for thirty years, and both in his practice and his writings developed the various operations for these growths.

Emmet³ was first in developing a systematic technic for the removal of submucous fibroids, which he accomplished by means of traction with tenacula or with a cord slipped around the tumor, combined with morcellation of the tumor. He operated by this method from 1863 to 1884, and removed many fibroids, some of them of large size. The first use of traction and morcellation in a systematic manner in the performance of vaginal myomectomy must be credited to Emmet.

Thomas⁴ added to traction and morcellation combined with hysterotomy the detachment of the tumor by means of a serrated scoop or spoon saw.

¹ Amussat, J. Z.: "Mémoire sur l'anatomie pathologique des tumeurs fibreuses de l'utérus et sur la possibilité d'extirper ces tumeurs lorsqu'elles sont encore contenues dans les parois de cet organe," Paris, 1842.

² Atlee, Washington L.: Prize Essay, "The Surgical Treatment of Certain Fibrous Tumors of the Uterus," etc., Trans. Amer. Med. Assoc., 1853, vol. vi, p. 559.

³ Emmet, Thomas Addis: "Gynecology," Phila., 1884, pp. 587-607.

⁴ Thomas, T. Gaillard: "A New Method of Removing Interstitial and Submucous Fibroids," Archiv. Medicine, N. Y., 1879; *ibid.*, "Diseases of Women," Phila., 1880, p. 541.

Péan¹ was the next great factor in the development of the technic of operations for the removal of fibroids. He operated both before and during the antiseptic era, and, assisted by the evolution of surgery in general, he was able to develop the technic of vaginal myomectomy to the position which it occupies at this time. He systematized hysterotomy, first employed by Amussat, and also improved upon the methods of traction and morcellation introduced by Emmet and Thomas.

Doyen² and Veit³ have more definitely systematized the operation, especially in connection with the employment of anterior hysterotomy.

Indications.—Vaginal myomectomy is indicated for the removal of:

1. Infected submucous fibroid tumor, whether contained in the cavity of the uterus or undergoing expulsion into the vagina. The comparative safety with which such tumors may be removed by the vaginal route is in striking contrast to the risks of abdominal hysterectomy under these conditions.

2. Fibroid polyp.

3. Submucous fibroid when single and not of too large a size. Medical literature shows that even tumors weighing as much as six or eight pounds can be removed by vaginal myomectomy; but large tumors are much more easily and safely removed by abdominal hysterectomy. A tumor having a diameter of 12 cm. is a reasonably upward limit for this operation. The age of the patient is an important factor in deciding for or against vaginal myomectomy in a relatively large tumor. If the patient is under thirty-five and childless, or desirous of bearing children, the indication is much stronger than though she is older and has children.

4. Cervical fibroids of moderate size. These are easily reached by means of hysterotomy and can be enucleated with ease and safety.

5. Intramural fibroid when single, and especially if moderate in size and situated in the anterior wall, can be removed with advantage by anterior hysterotomy.

6. Subperitoneal fibroid, when moderate in size, can be removed by vaginal celiotomy either anterior or posterior.

Contraindications.—The chief contraindication to vaginal myomectomy is the size of the tumor. The technic of abdominal myomectomy and hysteromyomectomy has been so improved, and the operations are relatively so safe, that it is unwise to attempt the removal of tumors weighing several pounds through the vagina. Medical literature shows the feasibility of the operation as performed by Péan and his followers, notably Doyen, Landau, and Wertheim; but their results merely demonstrate the possibilities of the operation and not its relative desirability. The removal of a large tumor per vaginam is not only a very laborious and difficult process, but is attended with more risk than is true of its removal by abdominal section.

Lack of room in the vagina is a relative contraindication to vaginal myomec-

¹Péan, J.: "Hysterotomie vaginale," Congrès Français de Chirurgie, Paris, 1897, p. 831.

²Doyen, E.: "Technique chirurgicale," Paris, 1897, p. 404.

³Veit, J.: "Ueber vaginale Myomectomie," Verhandlungen der Gesellschaft f. Geburtsh. u. Gynäk. zu Berlin, Zeitschr. f. Geburtsh. u. Gynäk. 1896, Bd. xxxiv, S. 109.

tomy. When otherwise strongly indicated, room may be secured by incising the perineum alongside the rectum. This should be avoided whenever possible.

For a consideration of the natural history, pathology, symptoms, and diagnosis of fibroid tumor, the reader is referred to the chapter on Abdominal Myomectomy and Hysteromyomectomy.

Operation.—The preparation of the patient is that indicated for both plastic and abdominal operations. The operation is best performed in the lithotomy position. The immediate preparation for the operation is that described in the chapter on Preparation for Plastic Operations. Among other instruments which are essential or very useful for the operation are the usual instruments for curetage, the Edebohls self-retaining speculum, vaginal retractors, at least six museau forceps, heavy scissors, straight and curved on the flat, and heavy volsellum forceps.

The details of the operation vary, depending on (a) whether the tumor can be removed through the dilated cervix, (b) whether hysterotomy is necessary, or (c) whether vaginal celiotomy is required.

Removal of the Tumor Through the Dilated Cervix.—When the cervix is not dilated, it will usually be necessary to perform hysterotomy, but in the case of small fibroid polyps, rapid dilatation of the cervix by means of dilators will suffice to gain access to the uterine cavity. The tumor is then seized with a polypus forceps and either twisted off by rotation or its pedicle is snipped with the scissors. When the cervix is already dilated, the tumor, whether partly protruded through the cervix or in the uterine cavity, is seized with heavy volsellum forceps and its connections to the uterus explored with the finger or sound. As a rule, the enucleation of the tumor is best begun by traction to develop the connections of the tumor. Then the capsule of the tumor should be incised near the junction of the tumor with the uterine wall and traction continued. If traction alone is not sufficient to deliver the tumor, it must be detached from its bed, preferably by means of the finger. At times a blunt instrument, such as blunt-pointed scissors, may be useful for this purpose. As the tumor is drawn down, the capsule should be further incised until it is delivered. When the tumor is too large for its easy delivery entire, it may be split and decentralized by morcellation. This maneuver greatly facilitates the delivery of large tumors, when it is determined to remove them by the vaginal route. After the delivery of the tumor any capsule remaining should be trimmed with scissors. The cavity of the uterus should then be carefully curetted and irrigated. A firm tamponade of the cavity of the uterus is desirable to control any tendency to oozing hemorrhage. In the experience of the author a serious hemorrhage has never occurred after a vaginal myomectomy. The vagina also may be lightly tamponed.

Removal of the Tumor by Means of Hysterotomy.—When the cervix is undilated and when the tumor is too large to be removed through a partly dilated cervix, the operation is greatly facilitated by incising the cervix. As a rule, anterior hysterotomy is to be preferred. In certain cases bilateral division of the cervix, or a posterior incision, may be preferable. For the removal of cervical fibroids

the incision should be in that portion of the cervix which gives readiest access to the tumor. Incision of the cervix in the middle line anteriorly or posteriorly is less apt to cause hemorrhage, and also less apt to involve injury to the uterine veins in subsequent manipulations. When considerable room is necessary, it can be secured by detaching the vagina from the cervix, as in the first step of vaginal hysterectomy, and then pushing up the bladder in front, or the connective tissue behind, to the peritoneal reflection. The uterine tissue can then be divided without opening the peritoneal cavity. When still more room is required, the peritoneal cavity must be opened, thus adding a vaginal celiotomy to the other steps of the operation. As a rule, the incised uterine tissue bleeds but little, and such oozing can be easily controlled by traction upon each side of the uterine incision. Two museau forceps should be attached to each side of the uterine incision for purposes of traction.

When the tumor is exposed, it is removed in the same manner as described for the operation performed through the dilated cervical canal. Traction, torsion, enucleation, splitting, and morcellation with decentralization of the tumor, are the principles involved.

After the removal of the tumor the incision in the uterus is repaired by means of catgut sutures. The vagina may be reattached to the cervix by suture when the oozing can be checked. When this is doubtful, a gauze tent should be placed in the wound for drainage.

Removal of the Tumor by Vaginal Celiotomy.—For the technical details of vaginal celiotomy the reader is referred to Chapters XV and XVIII.

For the removal of submucous or intramural fibroids, the methods described in the last section are applicable. For the removal of subperitoneal fibroids upon either the anterior or posterior walls of the uterus or the fundus, the uterus should be turned forward into the vagina through the anterior celiotomy incision. The method is applicable to the removal only of tumors of such size as to permit the delivery of the uterus and tumor through this incision without risk of tearing the pelvic structures. The technical details of the myomectomy itself are the same as those described for abdominal myomectomy (see Chapter XIX).

After the closure of the myomectomy wound, if the tumor was situated upon the anterior wall of the uterus, the risks of the operation are lessened by suturing the vesical peritoneum to the anterior wall of the uterus above the former location of the tumor; then if secondary oozing should occur, it would be extraperitoneal and would drain into the vagina. If the tumor was located upon the fundus or upon the posterior wall of the uterus, the same object is accomplished by placing a gauze drain in Douglas' pouch through a vaginal incision made for that purpose. As the danger of myomectomy performed through the vaginal celiotomy incision consists in secondary oozing and septic peritonitis, these two procedures tend greatly to lessen the risks of the operation.

At the conclusion of the myomectomy the vagina may be loosely attached to the cervix, with a gauze tent placed in the wound to provide drainage; or the

vesical peritoneum may be sutured to the anterior wall of the uterus and the vagina sutured to the cervix. The last is not advisable unless all oozing has been satisfactorily controlled.

In all cases of removal of submucous fibroids the endometrium should be cureted and wiped dry, when irrigation is contraindicated, and the cavity of the uterus should be packed with gauze. The vagina also should be lightly tamponed.

The *after-treatment* is the same as that for plastic and abdominal operations combined.

Prognosis.—The risks of the operation are small if the patient is in good condition and the uterovaginal canal is not septic. There have been two deaths in a series of 47 vaginal myomectomies in the practice of the author. In 33 cases the tumors were not septic and the operation was without mortality. In 14 cases in which the tumor was necrotic and the patients more or less septic, there were two deaths. Both patients died of pulmonary embolism. In one the source of the embolus presumably was an endocarditis present before operation; in the second, presumably it was from phlebitis and thrombosis of the pelvic veins.

CHAPTER XXI.

RADICAL ABDOMINAL HYSTERECTOMY FOR CANCER OF THE UTERUS.

By JOHN G. CLARK, M.D.

A radical abdominal hysterectomy consists in the widest possible ablation, through an abdominal incision, of the uterus, broad ligaments, and appendages, with the careful dissection and removal of the adjacent pelvic lymph-glands. Until 1894 either a simple vaginal or abdominal hysterectomy was performed for cancer of the uterus, no attempt being made to remove any of the adjacent tissue or any of the lymph-glands which might be the seat of metastasis. Gynecologists were divided in opinion as to the merits of these two operations, the majority very earnestly advocating vaginal hysterectomy because of its lesser mortality, while the minority very strongly championed the abdominal operation as being more efficient in the removal of the cancerous tissues.

The first epoch in the history of abdominal hysterectomy was made by Freund, January 30, 1878, when he extirpated a cancerous uterus through an abdominal incision. Up to this time no well-defined plan for the eradication of this disease by an abdominal operation had been attempted. While there have been many modifications of Freund's operation which have widened its scope from a comparatively simple to a very radical procedure, the principles then laid down for the removal of the uterus are still followed. To the inventive genius of this pioneer, therefore, must be given the credit of establishing the general basic principles underlying abdominal hysterectomy for cancer. So well is his priority recognized that many continental writers, in discussing the radical operation now in vogue, speak of it as "the extended Freund operation."

Freund's operation was not a precipitate one, performed upon the spur of the moment, but was a well-defined plan which had been elaborated upon a cadaver, and he was therefore well informed as to every detail which he proposed to execute upon the living subject. An incidental point of interest is that he employed in his first operation an elevated posture identical with that later suggested and popularized by Trendelenburg. Briefly summarized, Freund's operation consisted of the following steps:

1. Incision in the linea alba, beginning a short distance below the umbilicus and reaching to near the symphysis.
2. Packing back the intestines with damp towels, which, with the aid of the elevated dorsal posture, kept the field of operation free.
3. Release of the uterus from surrounding adhesions.
4. Transfixion of the fundus with a large ligature which was used throughout the operation as a tractor.

- In time it was found that in almost half of the cases a recurrence was noted within a year after vaginal hysterectomy, and that only 10 to 17 per cent. of cases went more than two years without a recurrence; also that patients who survived eight or ten years were rare exceptions. Such results as these put the surgical world in a receptive mood for any operative measure which appeared to be more effective for the eradication of cancer. During this interim aseptic surgery had been gradually developed, so that abdominal operations which had previously been attended with such fearful mortality were now comparatively free from danger, and consequently it was again possible to consider abdominal hysterectomy as a means of removing a cancerous uterus. The necessity for a more extended operation was self-evident, and as the efficiency of the operation for cancer of the breast had been greatly improved by the wide extirpation of the breast with the adjacent axillary glands, the analogy between cancer of the uterus and the involvement of the iliac glands appeared so evident that several more radical operations were almost simultaneously proposed.

TIME.	OLAHAUREN (KRÜKEN- BERG). CER- VIX, FUNDUS- CARCINOMA.		KALTENBACH (BULCHER). CERVIX- CARCINOMA.	FRITSCH (TANNEN).	LEOPOLD.	MARTIN.	SCHAUTA.	KÜPNER.	
One year.....	188	26	..	65	154	..	Total.
	58.5%	69.2%	..	57.0%	77.1%	33.3%	Percentage of cure.
Two years.....	141	16	77	49	104	44	143	..	Total.
	44.7%	81.2%	27.2%	47.0%	49.0%	70.0%	58.4%	44.4%	Percentage of cure.
Three years.....	112	13	67	39	84	..	128	..	Total.
	37.5%	69.2%	29.8%	48.7%	46.6%	..	44.8%	..	Percentage of cure.
Four years.....	88	11	53	31	61	..	118	..	Total.
	29.5%	63.6%	30.2%	45.0%	52.4%	..	35.0%	..	Percentage of cure.
Five yrs. and more	51	6	36	11	47	..	113	..	Total.
	17.6%	66.7%	13.9%	36.0%	43.2%	..	31.5%	..	Percentage of cure.

Mackenrodt¹ described a combined operation, beginning first with the wide excision of the upper part of the vagina, then dissecting it free and suturing it over the cervix. Before doing this he used extensively the actual cautery to destroy the local growth at its primary site. Following this part of his operation Douglas' cul-de-sac was opened through the vagina and a voluminous gauze tampon was inserted to control any oozing that might occur. The abdominal cavity was then opened and the uterus, with a considerable portion of the broad ligaments, was detached. Great care was observed in pushing the ureters aside, and overlapping ligatures were so placed, beginning above and extending downward along the broad ligament, as to include the greatest possible amount of parametrial tissue. After the extirpation of the uterus the ligatures were pushed down into the vagina and the pelvic cavity was closed by suturing together the vesicorectal reflection of the peritoneum. This operation, therefore, was the first step toward the wider extirpation of the pelvic tissues along with the uterus.

In passing, it may be said that one very valuable addition which Mackenrodt insisted upon was the use of the actual cautery in the excision of all of the tissues.

Next Rumpf² extirpated the uterus with the broad ligaments, parametrium, and glandular tissue along the sides of the pelvic wall. His first care was to avoid injury to the ureters. After ligating the upper portion of the broad ligament he made an incision along the innominate line in order to remove by blunt dissection all of the parametrial tissue from the psoas muscle to the bladder. The uterine artery was then located and ligated at its origin for the purpose of facilitating the removal of the connective and lymphatic tissue in the base of the broad ligament between the pelvic wall and the uterus. After this thorough dissection of the broad ligament was completed, the pelvic wall along the line of the ureter was carefully palpated, and if any enlarged lymph-glands were detected, they were likewise carefully dissected out. After thus freeing the broad ligaments the operation was completed by a comparatively wide excision of the vagina through the abdominal incision, the actual cautery being employed for this purpose. The last step of the operation was the closure of the pelvic peritoneum.

Almost coincident with Rumpf's operation, Ries³ and the author⁴ also proposed a radical operation, having as its chief objects the wide extirpation of the primary site of the cancer as well as the extirpation of the lymph-glands. Ries believed that many more recurrences following the ordinary operations came from metastasis to the iliac lymph-glands than had hitherto been suspected. This investigator deserves the fullest credit for the first study of the lymph-glands in these cases, in which he demonstrated unquestionable metastases in a considerable

¹ Mackenrodt, A.: "Beitrag zur Verbesserung der Dauerresultate der Totalexstirpation bei Carcinom," *Zeit. f. Geb. u. Gyn.*, Bd. xxix, 1894.

² Rumpf: *Sitzung der Berliner Gesellschaft f. Geb. u. Gyn.*, Juni, 1895, *Centr. f. Gyn.*, 1895, Nr. 31, S. 849.

³ Ries, Emil: "Eine Neue Operationsmethode des Uteruscarcinoma," *Zeit. f. Geb. u. Gyn.*, 1895, Bd. xxxii, S. 266.

⁴ Clark, J. G.: "A More Radical Method of Performing Hysterectomy for Cancer of the Uterus," *Johns Hopkins Hosp. Bulletin*, Nos. 52, 53, 1895.

proportion of cases. At the time of the publication of Ries' article he had not had an opportunity to carry out his proposed operation on the living subject, but had fully demonstrated its possibilities on the cadaver. Both in the past and in the present Ries has very earnestly maintained that metastasis occurs very early in cancer of the cervix, and therefore believes the greatest assurance of a cure lies in the thorough extirpation of the lymph-glands. Both Ries and myself were largely influenced in advocating the removal of the lymph-glands by the improved results following the more radical operation for cancer of the breast.

In Ries' operation the cervix was first freed through the vagina, followed by packing the pelvis with iodoformized gauze. Following this, an incision was made from the symphysis pubis to the umbilicus, and a technic not unlike that described by Mackenrodt was carried out for the ligation of the broad ligament. After the broad ligament was free he split the peritoneum over the common iliac vessel, and through blunt dissection loosened all of the tissue down to its bifurcation. The ureter was carefully dissected free to its entrance into the bladder. The broad ligament was then ligated step by step. The bladder, after its separation from the uterus, was pushed off by blunt dissection. The next step was the ligation of the uterine artery as close to its source of origin as possible. The round ligaments were ligated some distance from the uterus and divided. With the completion of this part of the operation, the upper part of the vagina with its cellular tissue was excised and the peritoneum was closed over in the usual way, after which an iodoformized tampon was inserted into the pelvis through the vagina.

About this time an operation almost identical in its details with that of Ries was published by myself. It is therefore evident that Rumpf, Ries, and I came to our conclusions relative to the necessity for a more extensive operation about the same time, and that each operation was based upon the same general principle. Ries was unquestionably the first to insist upon the early metastasis of the lymph-glands. In my subsequent observation of these cases considerable doubt was raised as to the question of early metastasis by Cullen's study of Kelly's and my own cases, in which the presence of carcinoma in the glands seemed to be the exception rather than the rule.

Subsequently Wertheim fully adopted the principles of the radical operation, and made the most painstaking and extensive serial study of all the lymph-glands which were removed in his operations. As a result of this careful research he found in a large proportion of cases minute metastatic foci in the glands, thus fully sustaining Ries' conclusions concerning early metastasis. Wertheim also proposed a radical operation which, in its essential details, had been antedated by Werder,¹ of Pittsburgh.

As a historic summary the various epochs in the development of the more radical operations may be placed in the following order: (1) Freund's operation, 1878; (2) Mackenrodt's more extensive operation with the use of the actual cautery, 1894;

¹ Werder, X. O.: "A New Operation for the Radical Treatment of Cancer of the Cervix," *Am. Jour. of Obstet.*, 1898, vol. xxxvii, p. 289.

(3) Ries' observations concerning the metastasis of cancer of the pelvic lymph-glands; (4) a more radical operation proposed by Rumpf, Ries, and Clark, 1895; (5) simplification of the more radical operation by Werder, 1898; (6) confirmation of lymphatic metastasis by an extensive study of cases by Wertheim¹ and the adoption of a radical operation similar to Werder's, 1900; (7) perfection and change of details in radical operation by Wertheim,² 1903.

In my opinion the tendency will not be to a further extension of the radical operation, although Martin³ has advocated the extirpation of the bladder with implantation of the ureters into the rectum, in order to make the possibilities of the radical removal of the cancerous tissue more certain. Sampson⁴ has also suggested and carried out in a few cases the resection of the ureters and their transplantation higher up in the bladder, in order to clear out more thoroughly the lymph-glands, lymph-channels, and parametria. Both Martin's and Sampson's operations appear too radical, and should under no circumstances be generally adopted until they are justified by the experience of these and other skilled operators.

Before taking up the actual method of performing the radical operation, the statistics of the last decade must be studied, for they have greatly changed our viewpoints as to certain details and principles first employed in this operation.

RESULTS FOLLOWING THE RADICAL OPERATION.

As previously stated, vaginal hysterectomy was the operation of election from 1885 to 1895 by the majority of gynecologists the world over. The necessity for a more efficient operation was shown by the fact that most of the cases applying to the various clinics were turned away as hopeless, and of the small number of cases which were considered operable, over 50 per cent. sooner or later succumbed to the disease. The radical operation, therefore, was again taken up by many surgeons, and the last decade has done much toward testing its efficacy.

The principles involved in the more radical operation as proposed by Ries, Rumpf, and myself were: (1) The wide extirpation of the uterus and its broad ligaments, with a considerable portion of the vagina; (2) a careful dissection and extirpation of the pelvic lymph-glands. As the result of my experience I found this operation difficult and likely to be attended with a greater mortality than the simpler vaginal or abdominal hysterectomy, but I hoped that the ultimate results would fully justify this procedure. My own cases have been watched with the most absorbing interest, and my conclusions from these observations are

¹ Wertheim, E.: "Zur Frage der Radikaloperation beim Uteruskrebs," *Archiv f. Gynäk.*, Bd. lxi, 1900.

² Wertheim, E.: "Ein neuer Beitrag zur Frage der Radikaloperation beim Uteruskrebs," *Archiv f. Gynäk.*, Bd. lxx, 1901.

³ Martin, Franklin H.: "Removal of the Bladder as a Preliminary to or Coincidental with Hysterectomy for Cancer in Order to Extend the Possibilities of Surgery for Malignant Disease of the Pelvis," *Amer. Gynec. and Obstet. Jour.*, May, 1900, p. 395.

⁴ Sampson, J. A.: "The Invasion of Carcinoma Cervicis Uteri into the Surrounding Tissues," *Jour. Am. Med. Assoc.*, Oct. 29, 1904.

that the wide extirpation of the local tissues is still preferable and to be adhered to, but that the extirpation of the lymph-glands, carrying with it as it does a greater percentage of mortality, does not offer an adequate insurance against recurrences, and I have abandoned it. No one man's experience, however, is yet sufficient to answer any question pertaining to any phase of this subject, and the safest conclusion may be reached from a collective statistical study.

A very pertinent question in this study is: Does cancer give early metastasis? In answer to this question we have various and very divergent opinions. Ries still maintains that metastasis occurs very early, and has consistently adhered to the principle of glandular extirpation. Cullen¹ was one of the first investigators to go on record against this theory, for he found only a small proportion of cases with involvement of the pelvic lymph-glands. Cullen's view fully coincides with that of Winter,² who found cancerous glands in only 2 cases in 44 autopsies on patients when the disease was still confined to the uterus.

With the statements of Winter and Cullen before us, the necessity for the radical removal of the glands seemed much less urgent. Nevertheless, my own policy until within the last three or four years has been in favor of the radical operation, with extirpation of adjacent glands. Of late, as I have frequently stated, I consider the removal of the glands of prognostic rather than of curative value. As in many of the practical fields of surgery, so here the radical operation was more or less extensively employed, and Werder, of Pittsburgh, antedated Wertheim in his modification of the radical operation which possessed advantages over the methods employed by Ries and the author.

The statements of Cullen and Winter were quickly challenged by Peiser, Wertheim, Ries, and others, Wertheim claiming that metastases had been overlooked by these observers because serial sections had not been studied. Thus Peiser³ in a considerable number of autopsy cases found the glands involved in 50 per cent. Wertheim, after perfecting his operation, reported 60 cases in 1901, and as a result of careful serial sections of the glands removed, he found 31.7 per cent. of all cases involved, and in 15 per cent. of the earliest cases there were demonstrable metastases.

Schauta,⁴ whose experience with vaginal hysterectomy has been very extensive, has recently studied the question of glandular metastasis most thoroughly, and has furnished data which strongly sustains his plea for a radical local operation rather than a widespread search for pelvic lymph-glands. He therefore takes a strong issue with Wertheim. In this study of 60 cases, which had died either as the result of operation or from the natural effect of the disease, each case

¹ Cullen, T. S.: "Cancer of the Uterus," etc., 1900.

² Winter, G.: "Ueber die Recidive des Uteruskrebses, insbesondere über Impfrecidive," *Zeit. f. Geb. u. Gynäk.*, 1893, Bd. xxvii, S. 101.

³ Peiser, Eugen: "Anatomische und klinische Untersuchungen über den Lymphapparat des Uterus u. s. w.," *ibid.*, 1898, Bd. xxxix, S. 259.

⁴ Schauta, F.: "Die Berechtigung der vaginalen Totalexstirpation bei Gebärmutterkrebs," *Monat. f. Geb. u. Gynäk.*, Bd. xix, H. 4, 1904, S. 475.

has been most thoroughly investigated to determine the frequency of glandular metastasis, and the relationship of the pelvic to the higher retroperitoneal lymph-glands in this process.

In order to study the glandular areas according to topographic localities, he divides them as follows: (1) The sacral glands, which are found on the anterior surfaces of the sacrum and in the mesorectum; (2) the iliac glands, which are situated in the triangle between the external and internal iliac vessels, also along

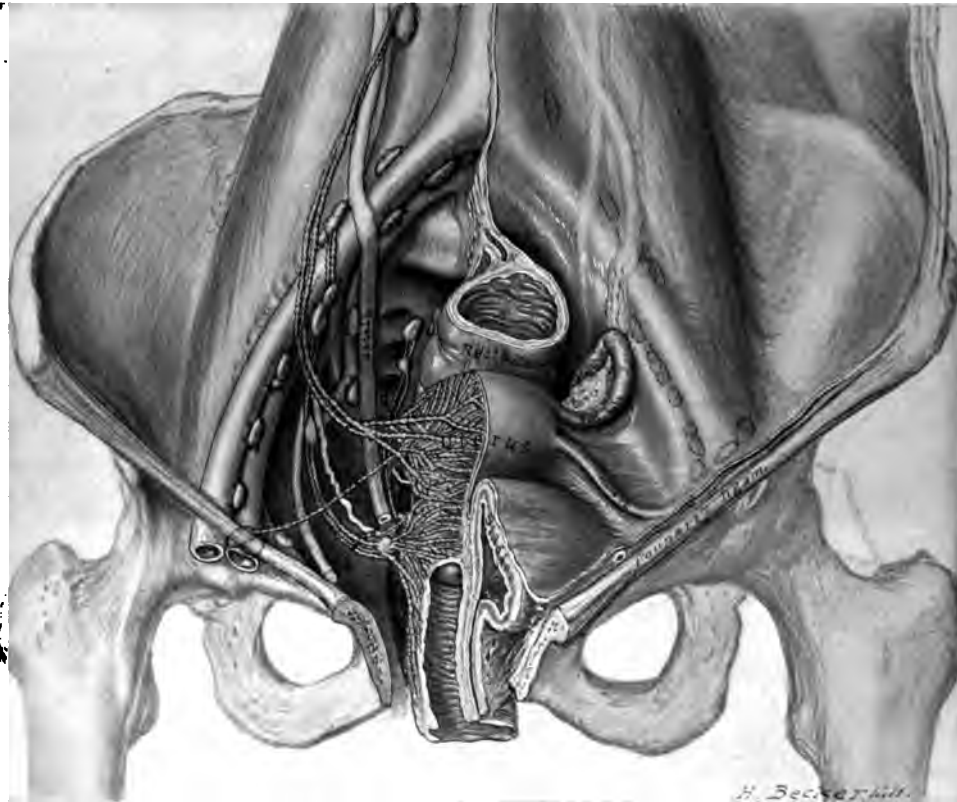


FIG. 342.—SCHEMATIC REPRESENTATION OF THE CERVICAL AND LUMBAR LYMPH-CHANNELS WITH THE LOCATION OF THE VARIOUS LYMPH-GLANDS WHICH MAY BE INVOLVED IN CANCER.

It is evident that only the glands situated at the bifurcation of the iliacs and in the base of the broad ligaments are really accessible to the more radical operation. Therefore, if there is glandular involvement there will almost certainly be a continuation of the cancer.

the course of the common iliac vessels. These two groups of glands he looks upon as being the so-called operable areas, in that they may be reached during the course of hysterectomy (Fig. 342).

Under the group of glands which cannot be reached by an operation are, first, the glands situated along the sides of the aorta, from its bifurcation upward to the renal vessels; second, the celiac glands, which are situated between the renal vessels and the diaphragm; third, the superficial inguinal glands; fourth, the deep inguinal

glands. While the inguinal glands are unquestionably operable, they are comparatively seldom involved in cancer of the cervix. Therefore, they need not be taken into consideration in the more radical methods of operation.

In Schauta's series of 60 cases, death followed operation in 11, 9 died of inter-current affections, and 40 from the natural termination of the disease. In considering the question of operation in these cases from the standpoint of glandular metastasis, Schauta divides them into the following groups: Group 1, both the lower and upper series of glands free of disease in 26 cases, 43.3 per cent.; group 2, the lower pelvic glands carcinomatous, while the upper glands were free in 8 cases, 13.3 per cent.; group 3, the lower glands free, but the upper the seat of metastasis in 5 cases, 8.3 per cent.; group 4, both the upper and lower series of glands involved in 21 cases, 35 per cent. While it is evident from this study that there were 48.5 per cent. of cases in which the lower glands were carcinomatous, but 13.3 per cent. could have been saved by the most radical operation, for in the remainder the upper series of glands which could not be removed were involved.

It is also a rather startling fact that notwithstanding that the majority of these patients came to their death as the result of the natural termination of the disease, 43.3 per cent. were entirely free of carcinomatous metastasis. In my opinion it is this class of cases with which we must definitely reckon in considering the permanent cures following hysterectomy for cancer.

Relative to the time of metastasis, all observers recently have pointed out the apparent paradox that the extent of the disease by no means furnishes any criterion as to the presence or the extent of the metastasis. Also another fact which has been prominently brought into the foreground, especially by Schauta, Kundrat, and others, is that the size of the gland is of no clinical value in deciding whether it is the seat of cancer. In this series of Schauta's it is seen that notwithstanding that the majority of his patients died without operative intervention, in almost one-half the cancer was still a local disease. As yet no one has satisfactorily explained the peculiarities of metastasis in these cases, why a cancer which is only starting upon one lip of the cervix should give metastasis, and another case of the most advanced involvement should be free from this complication. Another peculiarity of glandular metastasis is that a lymph-gland may be greatly enlarged and can be palpated as a well-defined mass, and yet not be involved, whereas an adjacent gland is found on microscopic examination to be the lodging-place of cancer cells. Relative to this question of lymphatic metastasis, Schauta, Krönig, and others are skeptical as to whether cancer cells always continue to develop after they are lodged in the lymph-glands. They believe that in a certain proportion of cases the malignant cells do not grow, but are either retained in the lymph-glands as foreign bodies or undergo degeneration and are destroyed.

From these observations, therefore, it would seem that the prolongation of a radical operation in the search for lymph-glands, with its attendant higher mortality, is not justifiable. This is certainly true if, in general, Schauta's observations are verified, that in only 13.3 per cent. of cases where there

is a glandular metastasis is it localized to the pelvic areas, which might be totally extirpated. Then, too, a point which has been prominently considered lately is the fact that the glands alone are not the sole nesting-places for the cancer cells, for the lymph-vessels and connective tissue surrounding these vessels have, in some instances, been involved.

With these facts before us, the outlook for great improvement in the final mortality rate, following a more radical operation with the extirpation of the lymph-glands, is, to say the least, not encouraging. While we may consider these statistics as compiled by an operator who is prejudiced in favor of vaginal hysterectomy, we do not find much to offset Schauta's conclusions in the work of Wertheim and his assistant, Kundrat, who are strong partisans in favor of the radical operation. As a result of Schauta's study he comes to the following conclusions: First, in any case of uterine cancer in which the operable group of glands is involved, it is probable that the higher situated glands are likewise invaded, thus making a radical operation impossible; second, large, hard, infiltrated glands are frequently not cancerous; third, even the smallest glands may be cancerous; fourth, cancer may not be strictly confined to the glands, but is found in lymph-spaces, connective tissue, or in veins between the glands.

In Wertheim's last report of cases I am inclined to the opinion that he has not sustained his position; on the contrary, I believe he has furnished statistics to his opponents. In Kundrat's study of 80 operative cases of Wertheim's he found the location of the cancer as follows:

A. Cervix involved, both parametria free, lymph-glands of both sides free.....	32	cases
B. Cervix involved, one parametrium involved, lymph-glands of both sides free	15	"
C. Cervix involved, both parametria involved, lymph-glands of both sides free..	7	"
D. Cervix involved, one parametrium involved, lymph-glands of the same side involved.....	7	"
E. Cervix involved, one parametrium involved, lymph-glands of the opposite side involved.....	3	"
F. Cervix involved, both parametria involved, lymph-glands of one side involved.....	7	"
G. Cervix involved, one parametrium involved, lymph-glands of both sides involved.....	4	"
H. Cervix involved, both parametria involved, lymph-glands of both sides involved.....	4	"
I. Cervix involved, parametria free, lymph-glands of one side involved.....	4	"

From this analysis of Wertheim's cases it will be seen that in 54 the lymph-glands were not involved, and therefore the extirpation of the pelvic lymph-glands at least could be said not to have helped the prospects of permanent cure, while the same procedure certainly was attended with greater dangers of immediate mortality. If to the remaining 26 cases we were to apply the results of Schauta's research, only 13 per cent. were operable from the radical standpoint, for if his observations are correct, in only this small percentage was the metastasis located solely in the pelvic glands accessible to the radical operation.

In considering how cancer of the cervix grows, Kundrat divides these cases into three groups:

1. The cancer grows in a compact mass, spreading uniformly out into the parametrium, and involving the latter in such a way that the growth is not sharply circumscribed. In a second class of this group the carcinoma is well circumscribed to the cervix, but in one place there is an outgrowth into the parametrium, usually along a lymph-channel around the blood-vessels, occasionally along the nerve-sheaths.

2. Cancer sharply circumscribed to cervix, but out in the parametrium metastases either in the lymph-nodes or in the lymph-vessels.

3. Cases in which both groups are combined, the primary tumor either growing *in continuo* from the cervix into the parametrium, and further out in the parametrium metastasis, or the cancer grows *in continuo* on one side, while the metastasis is on the opposite side.

That Wertheim is laying less stress upon the extirpation of the glands is, I believe, shown in two paragraphs in his report of 1901. He says: (1) It is an error to consider that the chief stress is laid upon the extirpation of the glands,—just as important, indeed more important, is the widest removal of the parametrium; (2) according to his latest observation it is not necessary to remove the glands if they are not enlarged.

Contrary to Wertheim's conclusions upon this last point, Oehlecker, v. Rosthorn, Krömer, Cullen, Sampson, and others claim that the size of the gland bears no relationship to metastasis, for large beaded glands may contain no trace of cancer cells, whereas in the immediate vicinity a very small gland may contain many epithelial cells. Thus, Wertheim's latest statement, that unless the glands are palpably enlarged they need not be extirpated, is based upon a fallacy and cannot be maintained, for if, as now appears certain, the foregoing observers are correct, the entire force of Wertheim's argument in favor of the removal of the glands falls to the ground, and if he follows out the last principle we will never be able to determine how much the removal of the glands has actually increased the ultimate recoveries. Without doubt in a considerable number of cases in which the glands are not palpable they will nevertheless be the seat of metastasis. If the principle of glandular extirpation is to be of avail, then it must be systematically carried out in all cases, whether the glands are palpable or not. As I view this question, I believe that Wertheim's cases sustain rather than disprove Schauta's argument. From the study of Wertheim's operative cases, we find that in 59 per cent. the lymph-glands were not involved. In Schauta's series, consisting largely of cases dying from the natural results of the disease, 43.3 per cent. were free from glandular metastasis. Mackenrodt¹ very strongly protests against Schauta's objection to the removal of the pelvic lymph-glands and still advocates a radical operation. Because metastases have occurred in at least 50 per cent. of these cases at the time of operation is the strongest argument, in his opinion, for the removal of the glands, for if this is not done all will die. On the other hand, if the glands are removed some may be

¹ Mackenrodt, A.: "Drüsenfrage und Rezidive bei der Totalexstirpation," Monatschr. f. Geburtsh. u. Gynäk., Bd. xix, 1901, S. 815.

saved. In this statement Mackenrodt overlooks the much greater mortality incident to the radical operation, which, I believe, will more than offset the questionable number of ultimate recoveries which may follow the more radical operation. Certainly my own experience does not confirm his conclusions.

SYMPTOMS OF CARCINOMA.

That the symptoms of carcinoma are very slight in the beginning is shown from the fact that a very large proportion of cases, when the patient first consults a physician, are far beyond the hope of benefit from any operation. In Ols-hausen's experience, 46 per cent. of cases applying for treatment were operable; in Küstner's, 22.8 per cent.; while in Fritsch's there were only 19.5 per cent. The large percentage of inoperable cases is being reduced in those countries where the attention not only of physicians but also of women is being strongly called to the dangers of allowing an atypical menstrual or leukorrheal flow to continue without consulting a physician, especially if these symptoms arise about the time of the menopause. The reason why cancer in the past has been so frequently overlooked is primarily due to the fact that women have disregarded unusual discharges, feeling secure in the thought that it was merely a deviation from normal menstruation incident to the approach of the menopause, and it is a lamentable fact that this fallacy has often been sustained by professional opinions. Physicians in the past have frequently taken this same view, and have been most negligent in not insisting upon an examination and thus settling at once this very serious question.

Finally, there is a class of cases in which none of these primary symptoms are present. The patient upon the first evidence of atypical discharges may report at once to a physician, who finds that the new growth has already progressed beyond the bounds of possible operation.

In order to analyze as closely as possible and to determine what may be looked upon as the earliest symptom of this disease, Waldstein¹ has made a careful study of 219 cases in which initial symptoms were present. In this number there were 120 cases of atypical uterine bleeding and 75 cases of leukorrheal discharge; in 16 cases there was a simple increase in the quantity of the menstrual flow (menorrhagia); in only 7 cases was there any pain, and this was noted as a sacral backache. From this analysis it is evident that a metrostaxis, either in the form of a slight flow between the periods or of an increase in the amount of regular menstruation, is one of the chief symptoms in the majority of cases; while a leukorrheal discharge which is usually of a yellowish, acrid, more or less malodorous character, is always to be regarded with grave suspicion. *Therefore, to lay special stress upon symptomatology, the two chief danger-signs are an atypical hemorrhagic flow, either at or between the menstrual periods, and a more or less profuse leukorrheal discharge in women about middle life.* If either of these symptoms occur shortly before,

¹ Waldstein, Edmund: "Ueber die Erfolge der operativen Behandlung des Gebärmutterkrebses," Archiv f. Gynäk., Bd. lxi, 1900, S. 52.

during, or after the menopause, no physician is justified in treating the case for a week or even a day without insisting upon a thorough examination. Krömer has analyzed 776 cases relative to the age at which cancer occurs and has embodied his results in a very instructive chart (Fig. 343) which illustrates the point far better than the mere citation of statistics.

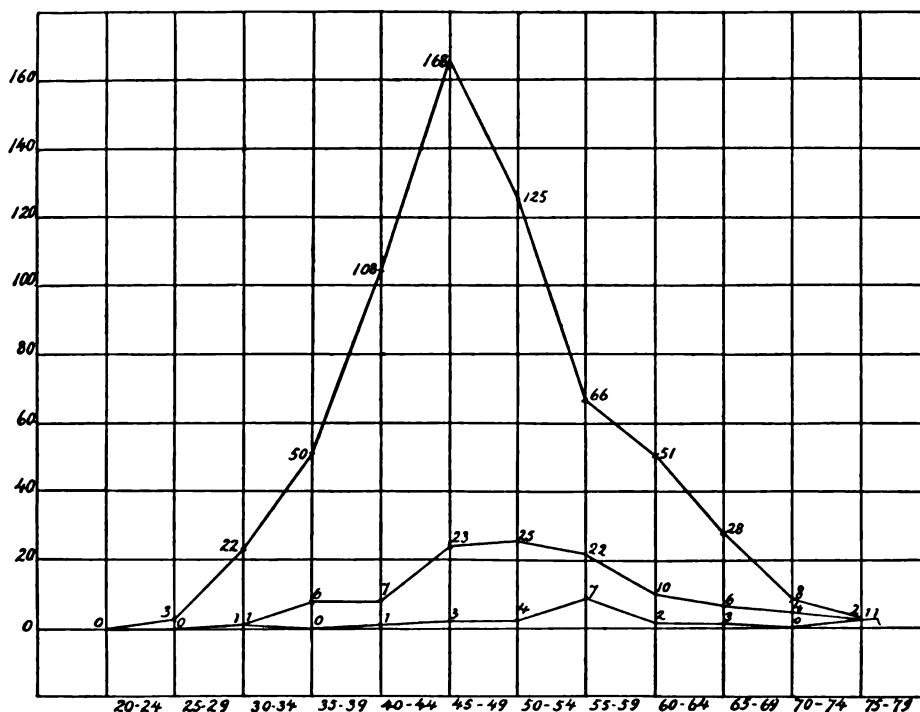


FIG. 343.—ANALYSIS OF 776 CASES OF CANCER OF THE CERVIX SHOWING THE PROPORTION OF CASES AT VARIOUS AGES (Krömer).

The upper line indicates cancer of the cervix; the middle, cancer of the fundus.

Although cancer of the uterus is essentially a climacteric disease, this fact must not give the physician a sense of security, for it may appear at any time from twenty to seventy-five years of age.

DIAGNOSIS.

From the foregoing paragraphs it is evident that the physician must be especially upon the alert to detect, first, the slightest symptoms pointing to cancer, and then to make at once a rigid bimanual and specular examination of the cervix; or if the cervix is intact and cancer of the fundus is suspected, to resort to a diagnostic curetage. The early diagnosis of cancer of the cervix will largely be determined by touch and visual examination. Any irregularity of the cervix which bleeds upon the ordinary vaginal touch should be considered cancer until it is proved otherwise by microscopic examination. Not infrequently I have seen

erosions or glandular hypertrophies in cases of laceration of the cervix which have bled upon touch, and yet there was no breaking off of small particles. In cases of this character one may proceed upon the assumption that it is merely a lacerated cervix, with a strong suspicion that it may be an early cancer. While we proceed upon the first assumption and either repair or amputate the cervix, we should invariably exclude the more grave possibility by a microscopic examination of the excised tissue. In one or two instances of this character in my own experience, hysterectomy has been performed a few days later upon discovering, through the aid of the microscope, that the case was malignant. In all cases of doubt a pathologic diagnosis must be obtained from a skilled specialist. It must be said that between a mediocre pathologist and an average clinical diagnostician, the patient stands a very much better chance of cure if the latter's opinion is followed than the former. It is because of the attempt on the part of men not skilled in the determination of pathologic changes in the endometrium or cervical epithelium to guide the surgeon that the value of this means of diagnosis has not infrequently fallen into disrepute. If the judgment of a skilled pathologist is followed very few errors, indeed much fewer, will be made in clinically doubtful cases than if the clinical side of this question alone is followed. This applies solely to the borderland cases, not to the cases which one usually sees. The latter are so plain that very little experience indeed is necessary to guide one to the right conclusions. In every city there are pathologists who are reliable, and they should be consulted in all cases of doubtful character. By following this policy not a few women will be saved from hysterectomy in which there is no cancer, whereas others will be hurried at once to a successful operation who otherwise would have been permitted to go until too late for a cure. Nothing is more reprehensible than to cast aside specimens from a curetage, or from cervical excision, when there is the remotest doubt as to the diagnosis. When submitting tissues to a pathologist for diagnosis it should be remembered that the lines of excision should pass entirely through the suspected area. Diagnostic curetage should include every part of the endometrium. Many times a failure in a microscopic diagnosis results from insufficient material, which could have been obviated had the surgeon kept this point in mind.

Again, the pathologic findings should always be associated with the symptoms. If the operator himself is skilled in the use of the microscope he will be able to weigh this question most judiciously. Every surgeon should carry in his bag a small four-ounce wide-mouthed bottle, containing 4 per cent. formalin, into which suspicious scrapings or bits of tissue should at once be dropped. Experience has demonstrated that formalin is the best fluid for immediate hardening, thus making it possible for the pathologist to render a quick diagnosis. If the fluid is not at hand 60 per cent. alcohol should be used. The name, age, and chief clinical symptoms should accompany the specimen. After the diagnosis of cancer has been established, the next point to be determined is the extent of local involvement, for upon this point depends the decision as to the type of operation to be employed. The vaginal fornix may be the seat of a well-defined ulcerative or cauliflower growth,

easily detected by digital examination. On the other hand, there may be slight subepithelial metastases outside the area of ulceration, detected as slightly raised or indurated plaques. The latter are most dangerous because they are most likely to be overlooked. If the cervix is only partially destroyed and these indurated plaques are distributed over the vaginal fornix, the chief therapeutic remedy should be the cautery. If the cervix has been completely destroyed and the vaginal fornix, especially the anterior part in proximity with the bladder, is involved, only a palliative operation is advisable, for no radical operation can offer any hope of cure. The broad ligaments, as has been demonstrated by Kundrat,¹ may be the seat of inflammatory exudate rather than of a carcinomatous deposit, and induration, therefore, is not to be taken as an infallible sign of parametrial involvement. While this observation may occasionally prove true, in general the rule is: If in conjunction with cancer of the cervix there is dense infiltration of one or both broad ligaments, the case is inoperable from the radical standpoint. In every surgeon's experience hysterectomy has been performed in which the knife has passed directly through indurated and apparently malignantly involved broad ligaments, and yet these cases have either survived a long time or have been actually cured. This happy outcome in an apparently hopeless case is based upon the fact that every indurated broad ligament is not necessarily cancerous. In judging the extent of a parametrial growth, as to the possibility of a radical operation, the pliability of the tissues out near the pelvic wall must be the index, for upon this decision will largely depend the measure of the surgical intervention. If a wedge-like growth has extended from the cervix out into one or both broad ligaments, and if the outer half or two-thirds are pliable, the radical operation should be performed. If, on the other hand, the base of the ligament is stiff and indurated out to the pelvic wall, no operation, or at most only a palliative one, may be performed.

Involvement of the uterosacral ligaments is best determined by rectal touch. These structures must be traced out from their cervical attachments to the wings of the sacrum. If they contain bead-like irregularities and enlarged glands are felt on the sacrum, the case is quite hopeless. Mere indurations of these ligaments, especially if in close proximity to the cervix, may be due to an inflammatory exudate such as is sometimes associated with old cervical tears, or in cases of chronic cervicitis. Here again the extent along the course of these ligaments must bias our judgment in favor of or against a radical operation. To lay down inflexible rules as to what cases may be subjected to the radical operation, to which there will be no exceptions, is quite impossible, for each surgeon must be influenced by his own personal views.

From my own experience I have established the following rules for guidance in determining upon what cases to perform the radical operation:

A. Cauliflower, ulcerative, or interstitial cervical growth, confined to the cervix, and without induration of the broad ligaments.

¹ Kundrat, R.: "Ueber die Ausbreitung des Carcinoms im parametranen Gewebe bei Krebs des Collum uteri," *Archiv f. Gynäk.*, Bd. lxix, 1903, S. 355.

B. The same group with the local extension, only slightly involving the vaginal fornix.

C. Interstitial or ulcerative growth extending not more than one inch into the broad ligament, well defined as a wedge-like mass, with the remainder of the broad ligaments soft and pliable.

The contraindications are local extensions into the posterior bladder wall or widely into the lateral vaginal fornix, extension of ulceration out into one or both broad ligaments, wide involvement of uterosacral ligaments, dense hard induration in one or both broad ligaments.

When cancer has extended so far in any direction that the resection of the bladder or ureter is necessary to circumvent it, then surgical measures will not, in my opinion, offer a sufficient hope of cure to justify so hazardous an operation.

PREPARATION OF PATIENT FOR RADICAL OPERATION.

While the increasing safety of operations has to a great extent rendered obsolete the prolonged ante-operative general treatment formerly in vogue, this older practice may nevertheless be recast with benefit in some cases of cancer. When there has been active bleeding the patient is always a bad subject for operation as compared with a similar degree of anemia in a case of myoma uteri or ectopic pregnancy. In the first there is not only hemic impoverishment but also a serious dyscrasia, while in the second class there is a simple anemia which will quickly return to the normal when the cause of the bleeding is eliminated. In a fibroid case in which there are periods of excessive hemorrhage succeeded by intervals of a partial or complete cessation, or in extrauterine pregnancy in which hemorrhage has ceased, the best surgical policy is to delay operation until the hemoglobin is increased to a safe surgical point. In cases of cancer, in attempting to check hemorrhages by local medicinal applications, the dyscrasia increases from the toxic action of the cancer; besides, all means of hemostasis are most inefficient. In these cases, therefore, we are between two horns of a dilemma,—one, the increased dangers of an operation in a very anemic woman, with a fetid septic area of necrosis to be surgically circumvented; and the other, the dangers of the occurrence of a metastasis or the wider local extension of the disease while endeavoring to correct these surgical contraindications preparatory to a radical operation. Between the two there is less danger in the second, for while a tentative general medical, or a local topical plan of treatment is most reprehensible, the prompt curetage and thorough cauterization of the local cancerous area, followed by a slight interval of forced feeding, and the administration of tonics, will, I believe, in the end bring better results, certainly so far as immediate mortality is concerned, without greatly endangering the patient because of local extension of metastasis.

While Wertheim for a time abandoned curetage and cauterization before performing a radical operation, he has again returned to this plan of treatment. His own statement concerning this matter is as follows: "After a careful preliminary

treatment of the cancer per vaginam by scraping and burning it with Paquelin's cautery, and after a thorough disinfection, the patient is placed in Trendelenburg's position, and the abdominal cavity opened by a median longitudinal incision between the symphysis pubis and umbilicus." Indeed, increasing experience among all surgeons seems to confirm the opinion that the cautery is our best therapeutic instrument against cancer. If the preliminary cauterization is followed in a week or ten days by the extirpation of the uterus by the same means, the probability of a cure may be actually increased rather than decreased. After closely observing these cases with and without this preparation, I am convinced that more is gained by this plan than is lost.

Before any operation is performed, the urinary functions should be closely studied. Although cancer in an operable stage never penetrates the bladder, it may push out into immediate proximity to the ureters. While a direct involvement of the ureters is a contraindication to any radical operation, yet this determination is difficult, for, according to Kundrat's observation, induration of the broad ligament is not always an indication of malignant extension, and may be simply an inflammatory exudate. A radical operation, when the induration of the broad ligaments is due to inflammatory changes, carries a probability of cure, whereas an operation upon a case in which this extension is due to cancer is hopeless. In the first case the ureters will likely not be obstructed; in the second, one or the other will very certainly be partly or completely occluded. A quantitative urinary estimate is, therefore, imperative. The patient must be put to bed and started at once on a course of forced feeding. At least two quarts of milk and four fresh eggs should be given daily. If this course is not expedient, or if the patient cannot take these foods, a very generous and nutritive bill of fare should be prescribed. Excessive purgation should be avoided; iron in some of its digestible forms should be given, but the chief care should be observed in prescribing a generous diet. Permanganate douches (1:1000) should be given twice daily. In order to reach positive conclusions as to the qualitative state of the blood, at least three separate readings of the hemoglobinometer should be made in order to eliminate as far as possible the natural errors which may occur with any hemoglobinometer.

While differential blood counts may be of some slight value, they cannot assist materially in the treatment of the case, and from a diagnostic standpoint are worthless. Two days will usually suffice for this preliminary study, when curetage and cauterization may be done. For this purpose general anesthesia is unnecessary,—indeed, is contraindicated, because nitrous oxid or ethyl chlorid will serve excellently. By placing the patient in the proper position for the operation and making the preliminary cleansing of the vagina without an anesthetic, very little time is required for the curetage and cauterization after the minor anesthetic is administered. In the removal of the carcinomatous material, as much as possible is dislodged with the fingers, after which it is cut down with a large sharp curet to a solid underlying tissue base. For the cauterization, the broad, blunt point of the electric or Paquelin's cautery should be employed, and it should not be used in a

mincing but in a very thorough way. Deep punctures should be made with the sharper point into the body of the cervix when it is hypertrophied and probably infiltrated with the new growth.

At the completion of this operation the vagina and external genitals should be coated with a thin film of vaselin, for slight scorching of the skin may occur unless the greatest care is taken in protecting the healthy parts with retractors. With a rapid anesthetic the patient recovers before she is taken from the operating table, and the ill effects of deep anesthesia are seldom noted.

After the cauterization one may wait until the necrotic débris resulting from the cauterization is shed, and the cauterized area assumes the reddish appearance of new granulation tissue, which will not be longer than ten days. If Byrne's observations prove to be correct, which time seems more and more to confirm, the vital interest of the patient, as already stated, is actually served rather than endangered by this interval between the simple curetage and cauterization and the radical operation. Winter, while strongly advocating curetage and cauterization, deprecates it as a preliminary step with an interval before hysterectomy, and makes it the first part of the radical operation. He directs that all preliminary preparation be carried out in one operating room and that hysterectomy be performed in a second. This plan is theoretically ideal, but is not, as a rule, practicable, nor is it really necessary if the greatest care is observed in keeping all instruments and basins used in the first operation separate from the abdominal instruments. Here the use of rubber gloves offers great security, for after the preliminary curetage the first pair of gloves is discarded and a second pair is used for the major operation. In this way a very careful technic may be carried out.

THE RADICAL OPERATION.

From the foregoing statistics it is evident that we cannot expect any marked improvement from the radical operation unless it is performed early, for it has no place in far advanced cases. Krönig has recently taken the position that even advanced cases of cancer should be subjected to operation. In this opinion, however, he stands almost alone, for the tendency of the last few years, even among radical surgeons, has been to limit the operation to early cases. As now performed it is completed from start to finish through the abdominal incision, which is a great saving in time as well as an improvement in technic in comparison with the combined vaginal and abdominal operation. The radical operation is now less extensive than when first instituted, therefore a strict adherence to the introductory definition of this operation is not possible. While it is more extensive than the operation in vogue before this question was first agitated, with further experience it has, I believe, been judiciously curtailed. The term radical should still be employed without designating it by any man's name, for as now performed it consists of the best suggestions made by several surgeons. In comparison with vaginal hysterectomy by means of Schuchardt's paravaginal incision, and the radical vaginal hysterectomy advocated

by Schauta, the radical abdominal operation certainly possesses decided advantages for the majority of surgeons. It is unquestionably better to work by sure sight than by an uncertain touch. In the abdominal operation the surgeon sees all stages of his operation; in vaginal operation he is compelled to rely upon touch in the most critical part of his work.

In my first article on the radical operation, the use of the ureteral catheters was strongly advocated, but in the last few years this rule has not been followed uniformly, and they have been used only when the ureteral area was encroached upon. With the greater facility of catheterization incident to the improvement in electric cystoscopes, ureteral catheters should more uniformly be employed, for it is the greatest possible assistance in the course of the radical operation to have these ducts constantly under touch. The ureters without this guide may easily be located in the

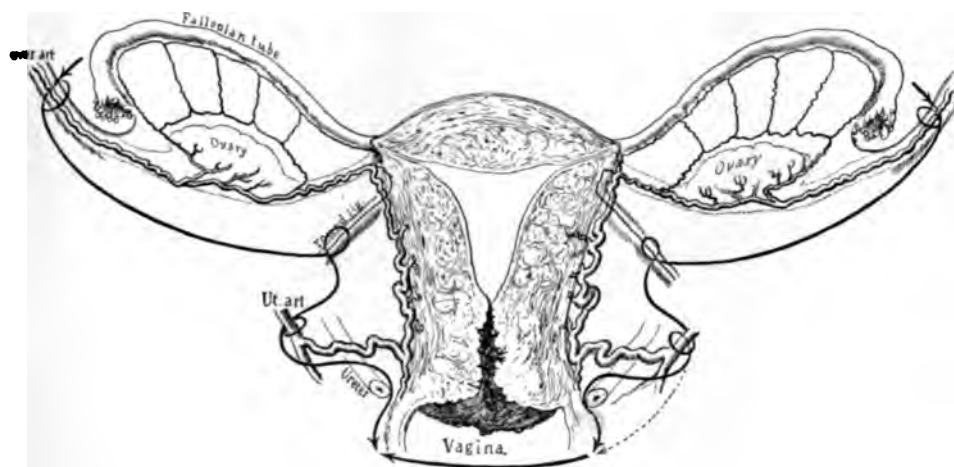


FIG. 344.—SCHEMATIC REPRESENTATION OF THE POINTS OF LIGATION AND EXCISION IN THE RADICAL OPERATION INDICATED BY THE CONTINUOUS ARROW LINE.

majority of cases, but occasionally it will not be the child's play that some surgeons would have us believe.

If the catheterization of the ureters is deemed necessary, it should be done before the general anesthetic is given. For this purpose the improved electric cystoscope should be employed, unless one is accustomed to or especially skilled in the introduction of the ureteral catheters by the Kelly method. Care should be observed to collect the urine during the operation, in order to determine not only the functional activity of each kidney, but also any qualitative difference in the urine of the two sides. With the completion of this preliminary step, which usually requires but a few minutes, the anesthetic is administered. As surgical shock is a very common sequel to hysterectomy for cancer, the conservation of the body temperature is urgently necessary. The patient should invariably be surrounded by hot-water bottles or should rest upon an electrically heated pad.

For the operation the patient is placed in a moderately high Trendelenburg

posture, and the abdominal incision is made from the symphysis pubis to the umbilicus. After opening the abdomen a careful control examination should be made to determine the palpable extent of the carcinoma, and the condition of the pelvic lymph-glands. First the extension of the disease out from the sides of the uterus can be judged relatively by grasping each broad ligament between the thumb and finger and following them out to the pelvic wall. By tactile sense we may ascertain whether there is only one gland enlarged, when it will be detected as a discrete



FIG. 345.—UTERUS PULLED FORWARD AGAINST SYMPHYSIS PUBIS. PERITONEUM INCISED ALONG THE COURSE OF THE URETERS.

nodule; or whether the entire cancerous process has extended out as a wedge-shaped process into the broad ligaments. After this examination is hastily but thoroughly made, the pelvic wall, and especially the group of glands at the bifurcation of the common iliac vessels, are palpated. The normal glands can only be detected with difficulty, while, if they are the seat of metastasis, they can usually be felt distinctly, varying in size from a pea to a small marble. Lastly, the uterosacral ligaments are traced out to their attachments to the wings of the sacrum. In some instances the sacral

chain of glands may be palpably enlarged, while those of the broad ligament are free; in fact, experience has shown that extension is very frequent along this metastatic route. Special stress should be laid upon the necessity of this preliminary survey, for as the question must now be viewed, it is useless to perform more than a simple abdominal operation if the higher groups of glands are involved, for in such cases we can only hope for a palliative effect from any operation. *If glan-*



FIG. 346.—UTERUS, OVARIES, AND TUBES DETACHED FROM THEIR SUPERIOR PELVIC ATTACHMENTS. Index-finger following the course of the ureter is thrust under the uterine artery and nerves as a guide for the location of the uterine vessels close to the pelvic wall.

dular metastasis or widespread extension is not discovered, the radical local extirpation offers the greatest possibility of a cure. If extension of the cancer is palpably evident in the iliac or sacral glands, the operation should be limited to a simple hysterectomy, or high amputation with the cautery, eradicating as completely as possible the local site of the disease. If, on the other hand, the preliminary oversight of the pelvic structures has been negative so far as metastasis or wide intraligamentary

extension is concerned, the scope of the local operation becomes radical. The intestines are packed well back into the abdominal cavity with gauze bolsters, wrung out of hot salt solution. Painstaking care in this step renders the operation much easier and will guard against post-operative complications. The uterus is usually grasped by a heavy tenaculum forceps, in the middle of the fundus, and is



FIG. 347.—UTERINE ARTERY LIGATED AND CUT.

Parametrium exposed preparatory to a thorough dissection and excision of this tissue with its lymphatics and glands.

forcibly drawn upward and to the opposite side from that upon which the operation is to begin (Fig. 345). The peritoneum is snipped open, as suggested by Wertheim, beginning over the bifurcation of the common iliac artery and continuing down into the pelvis to the point where the ureters enter the bladder (Fig. 345). The infundibulopelvic ligaments at the pelvic brim are next ligated doubly and cut between the ligatures. Some surgeons apply a proximal ligature and a distal clamp, but this multiplicity of clamps may impede the work, and in the event of hemorrhage deeper in the pelvis,



FIG. 348.—UTERINE ARTERIES LIGATED AND CUT.

Uterosacral ligaments (a) ligated. Dotted line in Douglas' cul-de-sac indicates the course of the peritoneal excision.

may be a source of serious embarrassment. Although this double ligation may add to the time, as a rule it will be found the better plan. The round ligaments are separately ligated one inch from the cornu uteri and divided. The peritoneal incision is now carried around in front of the uterus, through the uterovesical reflection to the opposite side. The bladder is detached from the uterus with a stalked sponge and the broad ligaments opened by the

same means. The uterus is sharply drawn upward into the abdomen, while the detachment of the bladder from the cervix is completed, and the dissection carried well down into the paravaginal tissues. In this way the vagina is detached from

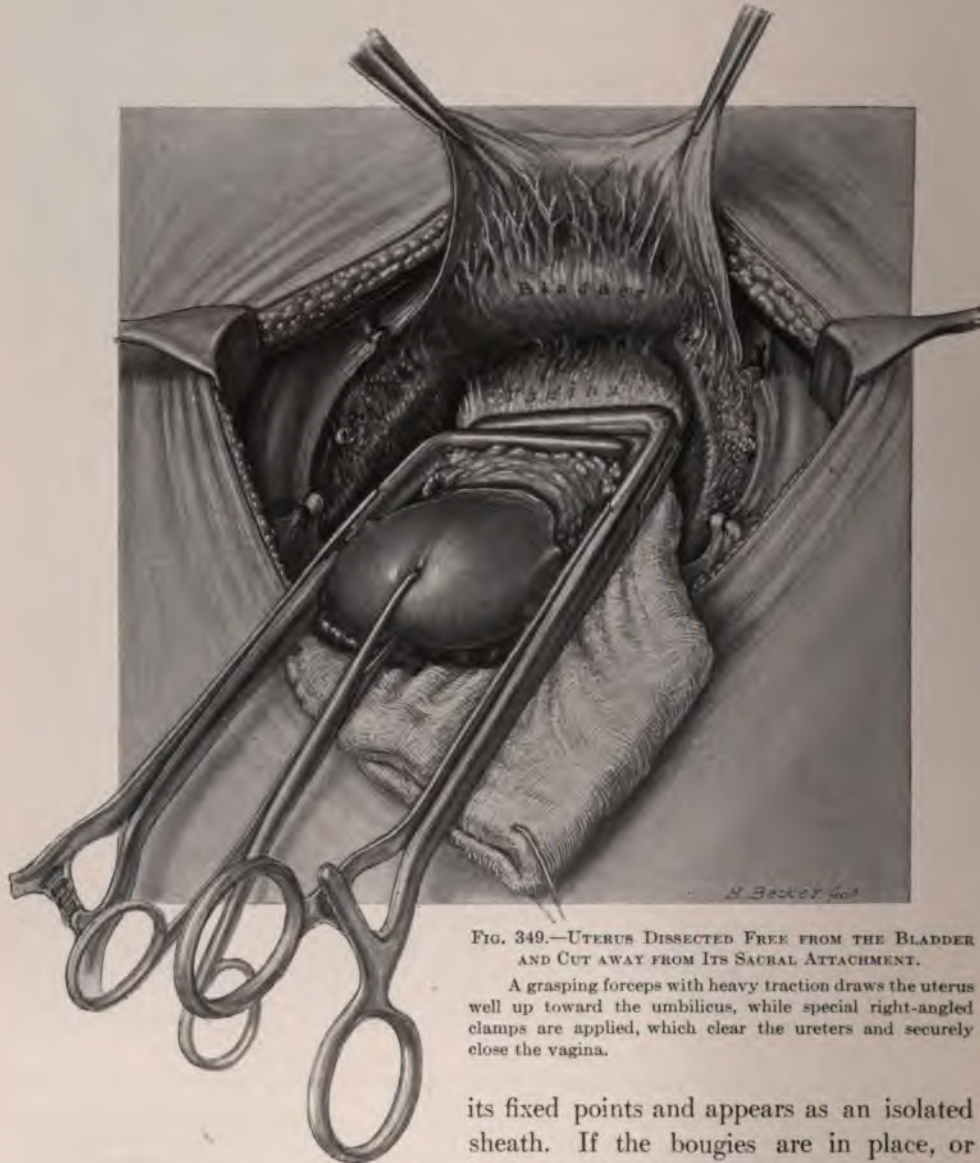


FIG. 349.—UTERUS DISSECTED FREE FROM THE BLADDER AND CUT AWAY FROM ITS SACRAL ATTACHMENT.

A grasping forceps with heavy traction draws the uterus well up toward the umbilicus, while special right-angled clamps are applied, which clear the ureters and securely close the vagina.

its fixed points and appears as an isolated sheath. If the bougies are in place, or if the topographic guides are depended upon, the ureters can most easily be located at the brim of the pelvis where they cross over the external iliac vessels. From this point they are traced downward to the points where they swing inward to enter the bladder. With the ureters thus isolated and pushed out of the way, the ligation of

the uterine vessels becomes a much easier and safer procedure. The vessels are lifted up on the tip of the index-finger and doubly ligated well out against the pelvic wall (Fig. 346). The suture can best be applied with a curved



FIG. 350.—UTERUS EXCISED BY MEANS OF THE CAUTERY BETWEEN THE TWO CLAMPS, AS DEPICTED IN FIG. 349. Mattress sutures applied below the lower clamp to check all bleeding. In many cases it is preferable to suture only the angles of the vagina leaving a middle opening for the insertion of a pelvic tampon.

aneurysmal ligature carrier. With this step duplicated on the opposite side, the chief source of dangerous hemorrhage as well as the further possibility of injury or ligation of the ureters is largely overcome. The broad ligaments are cut away from their pelvic attachments, leaving the uterus, its appendages, and the upper portion

of the vagina held in the pelvis by the uterosacral ligaments (Fig. 348). The uterus is now pulled upward and forward against the symphysis pubis to facilitate the division of the recto-uterine reflection of peritoneum and the uterosacral ligaments. The peritoneum should be opened well back of the cervix. The uterosacral ligaments are ligated or clamped and divided as close to their sacral attachments as possible. Small bleeding vessels may be clamped and subsequently ligated (Fig. 348).

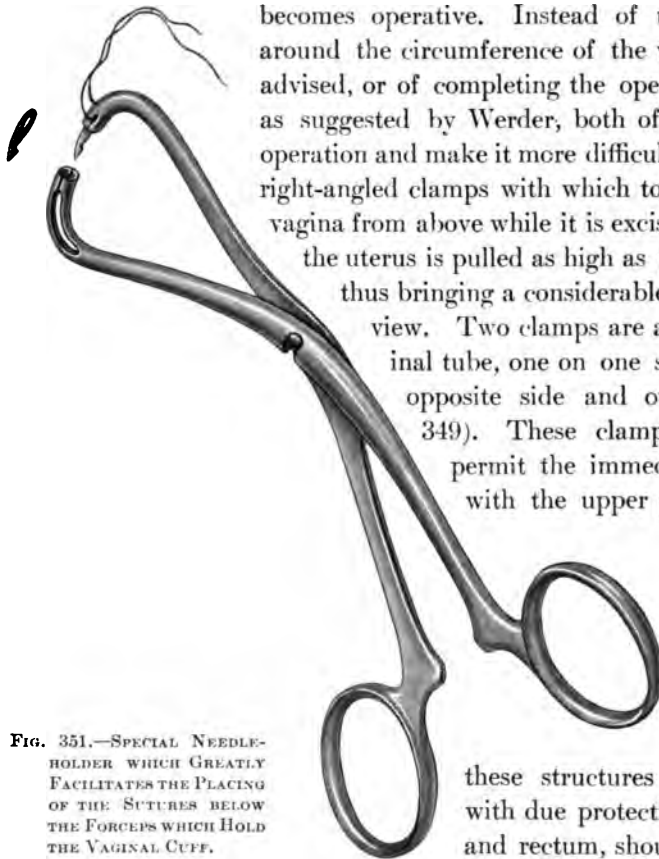
Up to this point the operation has followed the general plan of all radical operations, but here the best suggestion which Wertheim has offered becomes operative. Instead of using imbricated ligatures around the circumference of the vagina, as I have formerly advised, or of completing the operation through the vagina, as suggested by Werder, both of which plans prolong the operation and make it more difficult, Wertheim has employed right-angled clamps with which to compress the walls of the vagina from above while it is excised. With traction forceps the uterus is pulled as high as possible into the abdomen, thus bringing a considerable portion of the vagina into view. Two clamps are applied to the isolated vaginal tube, one on one side and the other on the opposite side and overlapping the first (Fig. 349). These clamps are quickly placed and permit the immediate excision of the uterus with the upper portion of the vagina. In

the division of the pelvic attachments of the uterus, and in cutting through the vagina, the cautery should invariably be employed, and after the excision of

these structures the surrounding tissues, with due protection of the ureter, bladder, and rectum, should be thoroughly burned.

This igni-extirpation is the strongest possi-

FIG. 351.—SPECIAL NEEDLE-HOLDER WHICH GREATLY FACILITATES THE PLACING OF THE SUTURES BELOW THE FORCEPS WHICH HOLD THE VAGINAL CUFF.



ble guard against a recurrence. While I believe the ligature should never be discarded, I recognize without reservation the splendid value of the cautery in excising cancerous tissue. With the cautery knife the tissue immediately adjacent to the organs to be removed is cauterized, and thus the frontier line of cancer may be destroyed, whereas with the knife it would escape. It is therefore incumbent upon every surgeon who expects to effect the greatest good by his operations to use the cautery. To those surgeons who are accustomed to the use of Downe's electric cautery clamps, they may be employed with splendid effect in this operation. With the completion of the extirpation the vagina is closed

below the clamps, with either a running or an interrupted catgut suture, and the clamps are detached (Figs. 350 and 351). If a gauze tampon is employed a small opening into the vagina is left, through which the gauze projects. After the completion of this step the vesical and rectal reflections of the peritoneum are brought together with a free running catgut suture (Fig. 352), and the abdomen is closed by whatever method the surgeon is accustomed to. A plan which has proved very satisfactory in my own hands is to close the peritoneum with a running suture of formalized cumol catgut, followed by the approximation of the fascia with a heavier suture of the

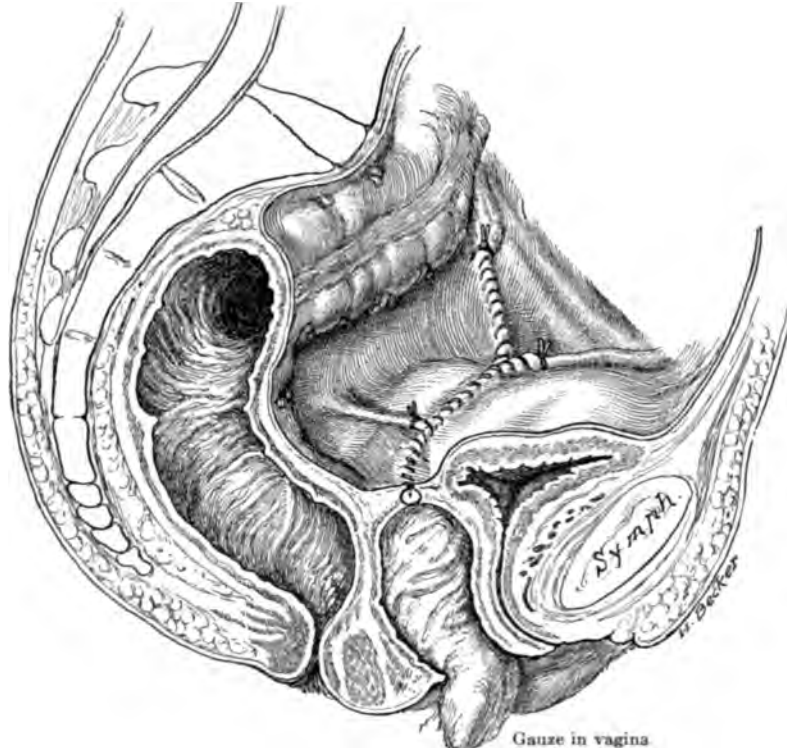


FIG. 352.—OPERATION COMPLETED.

Peritoneal covering over the exposed pelvic cellular tissue snugly closed. Gauze tampon inserted into the vagina, but not beyond this point. In some cases the vagina is left partially open and the tampon projects into the pelvic cavity to effect perfect drainage in case of infection or the occurrence of a vesical or ureteral fistula.

same material. If the fatty layer is abundant it is brought together with a fine running suture of catgut, and the closure is completed with a subcuticular suture of catgut. In many cases when the patient has suffered considerable shock from the operation the more rapid closure of the abdomen with interrupted silkworm-gut sutures is resorted to in order to hasten the patient's return to bed. In these cases the copious use of normal salt solution by colonic enemata, while the patient is still in the Trendelenburg posture, and leaving two pints in the abdomen, will usually quickly overcome the effects of shock and greatly hasten the immediate post-operative recovery. During the operation if the pulse rises to 150, submammary infusions should be resorted to for immediate stimulation.

If a vaginal tampon is inserted, and the peritoneum is not completely closed over it, the intraperitoneal infusion of salt solution should be omitted. It is perhaps safest in the majority of cases not to close the vagina completely, but to insert from above a small strip of gauze which will project into this canal. This will serve as an added insurance against hemorrhage, and if the pelvic area should be infected it will establish an exit into the vagina.

At the completion of the operation the bladder is catheterized. If ureteral catheters are used, they should be withdrawn at the earliest stage in the operation when they may be dispensed with, for to leave them indefinitely in place is at least theoretically objectionable. In my own experience I have never seen any traceable harm follow their employment; nevertheless, it is not wise to leave them unnecessarily long in place.

The abdominal dressing consists of a layer of silver-foil next the skin, and upon this one or two pads of gauze which are securely held in place by perforated adhesive straps. The Scultetus binder has long since been discarded with unquestionable benefit. Under our present plan the patient may be turned over on her side after the first twenty-four hours, and in general her movements are much less restricted than formerly. Richardson's suggestion, that patients be instructed to move their legs, is, I believe, a good one. This, in his opinion, will tend to offset the stagnation of blood in the extremities, which may be a predisposing factor in the formation of thrombi.

AFTER-TREATMENT OF PATIENTS.

The after-treatment of these patients differs but little from that of any other case of celiotomy. For the first twenty-four hours nourishment is restricted to liquids, such as albumin water, milk, beef peptonoids, or any of the various prepared foods which may prove acceptable to the patient. The prohibition of water for a given number of hours is an unnecessary cruelty, and the patient is permitted to have, at the discretion of the nurse, as soon as nausea subsides, frequent small draughts. Since we have so extensively given the saline solution as a peritoneal and colonic infusion, patients have suffered much less with thirst than formerly.

As these cases only differ in one or two respects from other cases, it is unnecessary to detail the after-treatment, except in so far as it bears upon these variations. Vesical complications are more frequent after the radical operation than any other class of cases. The chief of these is vesical irritability or cystitis, and, therefore, the urinary excretion should be constantly kept under close observation. This complication is so frequent and so persistent that Sampson has suggested as a routine measure the establishment of a vesicovaginal fistula at the completion of every operation. While this might be wise in cases where the bladder or ureters have been subjected to unusual traumatism, I believe the careful supervision of the vesical function and daily examinations of the urine will serve an equally satisfactory end. Should any vesical disturbance arise, especially if pus is noted, daily or even twice or thrice daily irrigations of the bladder with an argyrol solution (5 per cent.) may prevent a serious cystitis. Should a vesical fistula arise from local injury it

will in many instances close spontaneously. A ureteral fistula may likewise terminate as happily, although we cannot look forward to this spontaneous result so sanguinely.

If the ureteral fistula proves intractable after three or four months, and there is no recurrence of the cancer, it may be closed by vesical implantation through the vagina. In other cases the contraction of the scar tissue and the high situation of the ureteral defect may necessitate a second celiotomy and the implantation of the ureter at a higher situation in the lateral wall of the bladder. In such cases the use of the cystoscope is of incalculable value in determining the best course to pursue. To prevent concentration of urine, large quantities of water should be given; and as a routine measure to prevent cystitis, the administration thrice daily of a 5-grain tablet of cystogen or urotropin with Celéstin's Vichy will be most beneficial.

The second point in which these cases differ from the average abdominal section is the greater probability of a more or less serious infection. The lowered resistance of the patient is a strong predisposing factor to infection, while the nature of the operation opens a wider cellular field for microörganismal implantation and growth. In my experience this danger has manifested itself not so much in a greater mortality as in local wound infections, especially in the abdominal incision. If, therefore, a patient who has safely passed the critical days of convalescence begins to show a slight elevation of temperature, the abdominal wound should at once be inspected. If there is a local point of tenderness, the edges of the wound should be opened in order to liberate any infectious material and at once limit its further progress. In some cases where there is this slight rise of temperature, with vague tenderness over the incision, it may be hastened to "point" by the use of a flaxseed poultice, made with a 1 : 1000 bichlorid solution. This treatment is considered by some surgeons obsolete, or even harmful, but if properly applied in these doubtful cases it may serve not only a therapeutic but a diagnostic purpose. Even when the incision is red and indurated it will act as a soothing remedy, and will usually allay the acute pain, and actual subsidence of the infection without suppuration may occur.

PROGNOSIS.

Now that the abandonment of the dissection of the glands as a routine step may be sanctioned, and improvements in other respects have been made, the immediate mortality in skilful hands should not be greater than that of other more difficult abdominal operations—that is, not greater than 8 or 10 per cent. As very fat women are bad subjects for this or any other abdominal operation, it will usually be safer to perform a simple vaginal hysterectomy in such cases, especially if, as is often noted, the pelvic floor is greatly relaxed. With this exception I believe the abdominal operation will give the better ultimate results in cancer. Statistics as to recurrences in cancer may be most fallacious, for unless the patient has passed over five years without a reappearance she cannot be considered cured, and even after this time limit the patient may subsequently die from cancer. Nevertheless, it may be said as a general rule that if five years have elapsed without a recurrence, the patient is comparatively safe from a further appearance of the new growth.

The American statistics of the ultimate results from either vaginal or abdominal hysterectomy are especially meager. No one has systematically worked up his after-results, so far as I am able to discover, except Cullen, who has followed the cases operated upon by the various operators at the Johns Hopkins Hospital, and Noble, Janvrin, and Baldy, in their own services. In an article on "The Ultimate Results of Operation for Cancer of the Uterus" ("Philadelphia Med. Jour.," Nov. 9, 1901), Noble has given us a summary of 32 cases occurring in his own service. Of these 23 were cases of cancer of the cervix and 9 of the corpus, two of the latter being cases of syncytioma. Of the 32 cases 11 have since died, 10 of recurrence and 1 of pneumonia. Of the 21 cases remaining, 2 cases of cancer of the cervix are known to have recurrence, 6 cases have been lost sight of, and the remaining 13 are free from recurrence at the present time. The following tables give the length of time free from recurrence:

CANCER OF THE CERVIX.

1 to 12 years.
1 to 9 "
1 to 8 "
2 to 3 "
1 to 2 "
1 to 1½ "
1 to 1 "

CANCER OF THE CORPUS.

1 to 9 years.
1 to 7 "
1 to 5 "
1 to 4 "
1 to 3 "

Thus of the 32 patients there are 6 living and free from recurrence at the end of five years, which is equal to 18 per cent. There are 9 patients living and free from recurrence at the end of three years. Two of the additional 3 being cases of the body of the uterus, it is a fair conclusion that between 20 and 25 per cent. of the cases have been permanently cured.

Of the 9 cases of cancer of the corpus, 5 are accounted for in the table, 1 has been lost sight of, and 1 died of recurrence at the end of four years and five months. The remaining 2 cases were syncytioma, a condition quite distinct from adenocarcinoma of the corpus. Of the 2 cases, the first died of recurrence, and the second was so advanced at the time of operation that the removal of the cancer was necessarily incomplete.

Janvrin,¹ another American operator, reports his own ultimate results as follows: Abdominal and vagino-abdominal hysterectomy: 12 cases, 2 cured; more than eight years have elapsed since operation; 6 recurrences; 4 deaths from operation, 2 from shock, 1 from septicemia, and 1 from uremia. Percentage of cures, 16.6. Vaginal hysterectomies: 38 cases, 10 permanently cured; 15 recurrences, 4 deaths from operation; 10 lost sight of after a few months; percentage of cures, 26.3. Total number of cases, 50; 12 cured; general percentage of cures, 24.

In an article upon "Recent Statistics on the Primary and Ultimate Results of Hysterectomy for Cancer of the Uterus" ("Univ. of Penna. Med. Bulletin," May, 1901), the author reviewed the results of Cullen, Winter, and Wertheim. Cullen reported 61 cases of squamous-cell carcinoma of the cervix in which a most careful study of the pathologic specimens was made, and the further histories of the patients were as closely followed as possible.

¹ Janvrin, J. E.: "The Surgical Treatment of Early Diagnosed Cancer of the Uterus," *Trans. Amer. Gynec. Soc.*, 1903, vol. xxviii, p. 3.

In his summary of results Cullen says: "We learn some interesting facts, but on the whole the results are most distressing. In 4 cases, after starting the operation, the removal of the growth was found to be impossible, and further operative interference was abandoned. Nine patients died as a direct result of the operation; the subsequent histories of 4 could not be obtained, and these patients are probably dead, as the prognosis given at operation was unfavorable. Thirty-one have died, or have given unmistakable evidences of a return of the growth; thus out of 61 patients, we have now (January, 1900) 13 living and well. Some of the patients died shortly after leaving the hospital; others remained well for months; one patient lived for four years and two months, and then died from a pulmonary hemorrhage."

The length of time since the operation in the cases which were still living at the time of the publication of his book varied from ten months to six years. In only two of these cases, both of whom had lived over six years, is he justified in claiming cure.

This picture becomes more depressing when we learn that, in addition to the 61 cases which were deemed operable and in which the results were so unsatisfactory, 62 cases were turned away from the hospital because there was no possibility of even attempting a palliative operation for their relief. Unfortunately not one but many of those cases had been treated for weeks and months by topical applications or douches. The glandular type of cancer of the cervix (adenocarcinoma) gives no better results. In 12 cases in which hysterectomy was performed only 2 of the patients were living at the time of the publication of Cullen's book.

It is a pleasure and also reassuring to turn from this dreary picture of the usual termination after operations for cancer of the cervix to that of cancer of the fundus, for here the results are very much better. Of 30 cases of adenocarcinoma of the body of the uterus, 3 died as a result of the operation; 6 succumbed to local recurrence at periods varying from five months to two years and seven months. One could not be located. The remaining 20 were free from a recurrence at the time of the report. When we consider the fact that of the 30 cases of this type of cancer 20 were living at the time of the publication of Cullen's book, we are strongly sustained in our insistence upon the early diagnosis of these cases, for in cancer of the fundus, which is usually localized to the fundus and which is radically removed, there is no recurrence. If, therefore, the cases of cancer of the cervix are seen early before the new growth has spread into the broad ligament, or out into the vaginal wall, we may hope for much better results than have thus far been reported.

Cullen's general summary of cases of carcinoma of the uterus is as follows:

VARIETIES OF CARCINOMA.	OPERABLE CASES.	PATIENTS WELL JAN. 1, 1900.
Squamous-cell carcinoma of the cervix.....	61	13-21 per cent.
Adenocarcinoma of the cervix.....	12	2-16 " "
Adenocarcinoma of the body of the uterus.....	30	20-66 " "
CASES COMING TOO LATE FOR OPERATION.		
Squamous-cell carcinoma of the cervix.....	62	
Adenocarcinoma of the cervix.....	6	
Adenocarcinoma of the body.....	5	
Total.....	176	

Baldy¹ states that less than 5 per cent. of cases of cancer of the cervix are cured no matter what line of treatment is followed. Twenty-four cases of cancer of the fundus have passed through his hands. Of these, 3 were either too far advanced for operation or refused operative treatment. In the remaining 21 cases hysterectomy, supravaginal or the combined vagino-abdominal method, was employed. Two of these cases died as the result of the operation; of the remaining 19 cases, all were alive, with two exceptions, at the time of his report. One of the two died of pneumonia seven years after the operation; from the reports obtained the second case probably died of recurrence. Baldy states that making all allowance for mistakes and the general unreliability of statistics, about 75 per cent. of his cases of cancer of the fundus were free from recurrence. In striking contrast, the maximum percentage of survival of cases of cancer of the cervix was only 5 per cent.

Relative to the time of recurrence, the results are variable in the hands of different surgeons. As yet sufficient time has not elapsed since the more radical measures were generally instituted to determine whether they will give better permanent results. After vaginal hysterectomy the percentage of patients living over five years has widely varied.

Leopold claims that 43.2 per cent. of his cases were alive over the five-year period; Kaltenbach has only 13.9 per cent. to his credit. This wide discrepancy is no doubt due to the type of cases which these two gynecologists have selected. Leopold is very conservative, while Kaltenbach resorts to operation in every case where it is possible. An average estimate will, I believe, show not more than 18 per cent. of permanent recovery among gynecologists in general, and this may be even too high. The usual length of life after cancer of the cervix appears is not more than two years. Beckmann has made a comparison of two series of cases to determine the relative length of life in cases which were inoperable and those in which there was a recurrence after operation, to determine whether the average length of life is extended in the operative cases. His results are as follows:

DURATION OF THE DISEASE.	NO OPERATION (100 CASES).	OPERATIONS (35 CASES).
$\frac{1}{2}$ year.....	13.7	
$\frac{1}{2}$ to 1 year.....	25.2	9.5
1 to 1 $\frac{1}{2}$ years.....	35.9	9.5
1 $\frac{1}{2}$ to 2 ".....	22.1	23.7
2 to 2 $\frac{1}{2}$ ".....	2.1	23.7
2 $\frac{1}{2}$ to 3 ".....	1.0	19.1
3 to 3 $\frac{1}{2}$ ".....	0.0	9.5
3 $\frac{1}{2}$ to 4 ".....	0.0	5.0

The most frequent and rapid recurrences are noted after operations upon par-turient or puerperal women, whereas a greater number of cures are noted in women after the menopause. While this has been a general observation, no statistics have been offered until recently to sustain it. Hense, at the instigation of Winter, has gone into this matter carefully, and his statistics fully confirm the opinion above noted. Before the publication of this article an interesting observation had been

¹ Baldy, J. M.: "Cancer of the Uterine Fundus," Trans. Amer. Gynecol. Soc., vol. xxvi, 1901, p. 111.

made by Zweifel, who noted the rapid progress of cancer in a pregnant woman. The case was inoperable, and the patient was kept under close observation until the birth of her child. A small silk suture was passed into the tissue at the border of the carcinomatous area, and within fourteen days the cancer had spread two finger-breadths beyond this point. This observation shows the excessive rapidity of growth, and sustains the gloomy prognosis in parturient women. As found by Hense, the ratio of cures is 24 per cent. in pregnant or puerperal women, as against 30 per cent. in 230 non-pregnant cases reported by Winter. The reason for the worse results in pregnant women lies in the fact that during this period the tissues are soft and very vascular and the lymph-channels are much more active than in the ordinary state. The possibility of the rapid spreading of the new growth, both by direct continuity and through the vascular systems, is greatly favored.

In comparison with the results in pregnant women, a higher percentage of cures is noted in women who are operated upon after the climacterium.

In an analysis of the cases in the Königsburg and Berlin gynecologic clinics, there were 50 per cent. of cures in women past the menopause. From this study it is evident that the post-climacteric changes exercise a marked retarding action upon the growth of cancer of the uterus. This is apparently due to conditions opposite those noted in pregnant women; for in women after the menopause the pelvic tissues are all undergoing atrophy, and the blood- and lymph-supply are much less abundant. The conclusion, therefore, is evident: that operations upon pregnant or puerperal women give by far the worst results, and upon women after the climacterium the better ultimate results.

The chief complaint of all surgeons is that they see cancer cases too late, because either the patient or family physician has ignored symptoms which may have been present some weeks or months. To correct this serious fault two ways are open: The physician must acutely feel his responsibility, and should not only inquire minutely into all atypical symptoms of the climacterium, but should warn his patients at this age to carefully note these deviations and at once report to some physician for examination. In Germany the percentage rate of operability has steadily advanced during the past five years as a result of an active campaign started by Winter. Midwives have been warned as to their responsibility in these cases, and have been instructed to advise all patients to consult a physician at once about atypical discharges at the menopause. In this country the same plan should be instituted, and both women physicians and capable trained nurses should give instructions to laywomen by judicious talks before women's clubs and in the various guild settlements. Only by this early attention to these cases may we hope to save a larger number of cancerous patients from their direful fate.

NOTE.—Since the preparation of this chapter Wertheim has made a further report of his cases, and thus far his results far excel any hitherto published. His conclusions are unqualifiedly in favor of the radical operation after the latest review of his cases.

CHAPTER XXII.

THE BYRNE METHOD OF TREATMENT OF CARCINOMA OF THE UTERUS.

BY X. O. WERDER, M.D.

Among the gynecologists who have systematically employed the galvanocautery in the treatment of carcinoma of the uterus the late J. Byrne, of Brooklyn, unquestionably deserves first rank. He had been a lifelong enthusiastic advocate of the galvanocautery to the exclusion of all other methods, for which he not only never had the slightest sympathy, but on all occasions he denounced in the most scathing terms the prevailing tendency for radical mutilating operations for uterine carcinoma. It may be due to his extreme views in this respect, in a measure, that his work along these lines did not receive the serious attention which it certainly deserved at the time, because the minds of the surgeons were then directed toward efforts in developing more radical operations, expecting improvement in ultimate results from more thorough and complete extirpation of the uterus and adjacent tissues, rather than from such a simple, almost harmless operation as advocated and practised by Byrne.

He began the use of the galvanocautery for carcinoma as early as 1872, and continued its operation uninterruptedly in his practice until the time of his death, in the year 1902, improving and perfecting not only his apparatus and instruments, but also his technic, which he described very minutely in various monographs and society discussions. That he was a very skilful operator is sufficiently shown by his excellent results, both immediate and remote, his 367 operations for carcinoma of the uterus having been without any operative mortality. He must also have possessed no mean mechanical ingenuity and considerable knowledge of electricity, as is abundantly demonstrated by the numerous more or less original instruments and electrical apparatus devised by him for this operation.

A method able to accomplish such wonderful results certainly deserves a closer acquaintance and further investigation, and should arouse a deeper interest in the mind of every gynecologist than it has hitherto received. Why Byrne's method has found so few imitators under the circumstances, especially as it is safer than any other method and at least fully as easily applied, would seem almost inexplicable. When we consider the prejudice naturally existing in every surgical mind against the use of the cautery with its heavy, cumbersome apparatus, and strange, clumsy instruments so foreign to the surgeon's training, which are, in addition, often imperfectly made and not rarely at the most critical moment fail and disappoint, it is no wonder that the surgeon prefers to work with knife and scissors. The surgeon

also dislikes a wound which, though perfectly clean and aseptic, must heal by granulation instead of by primary union. Then the use of the galvanocautery requires at least a fundamental knowledge of electricity, which not every surgeon is able to acquire; work with it is often extremely tedious and slow, putting to the test the operator's patience and perseverance. The whole operation looks unsurgical, awkward, and clumsy, compared to a typical hysterectomy which gives the surgeon every opportunity of displaying his dexterity and operative skill. It is, therefore, not to be expected that the galvanocautery will ever supplant the radical operations now in vogue for the treatment of carcinoma of the uterus, unless it can be distinctly shown that the results obtained by the cautery are decidedly superior, not only in immediate results, but particularly in the percentage of permanent cures, to those following cutting operations.

These points, along with the considerable cost of the special complete outfit necessary for the performance of the Byrne operation, are probably sufficient explanation why Byrne's earnest pleas in favor of the galvanocautery attracted so little attention at a time when the surgical world expected so much from the more radical and complete operations for the cancerous uterus which were then just being tried. Lomer¹ very aptly remarks that "Byrne reminds me of a preacher in the desert who repeatedly and persistently proclaims well-known truths without being heard."

The time has now arrived, after giving the more radical operations a fairly good trial and finding that they have not been followed by the very material improvement in results so sanguinely and confidently expected, to return to Byrne's work and to take up the thread where he dropped it, with the hope that his method may bring equally good results in our hands, and that by extending and improving his technic along the lines mapped out by him we may perhaps succeed in increasing the percentage of cures obtained by him without adding very materially to the danger of his operation.

Instruments.—The instrumentarium required for this operation and used by Byrne consists of a battery, the Byrne self-retaining vaginal speculum, a double expanding tenaculum forceps, cautery knives, a cautery dome, and finally an electric wire loop, by which Byrne in suitable cases amputated the cervix uteri.

The battery, which was Byrne's own device and on the perfection of which he spent much time and labor, was very compact and simple in construction and seemed very satisfactory in its operation. At the present time, when the street current is almost always obtainable, a transformer seems much more convenient and satisfactory, and a battery can, therefore, very properly be dispensed with.

The Byrne self-retaining speculum which he devised for the purpose of separating the vaginal walls, especially in an antero-posterior direction, gives ample room for the necessary manipulations without the use of an additional assistant. The writer never felt quite at home with the Byrne speculum, and he found the ordinary

¹ Lomer, R.: "Zur Frage der Heilbarkeit des Carcinoms," *Zeits. für Geb. u. Gynäk.*, 1903, Bd. 1, S. 319.

self-retaining Auvard speculum with an anterior retractor and, when necessary

additional lateral retractors, not only better adapted to expose the field of operation, but also helpful to protect the vaginal canal and vulva against heat and injury during the operation. A good strong cautery knife is, of course, indispensable, and the most satisfactory instruments of this character which the writer was able to obtain were those manufactured by Lentz & Sons, Philadelphia, in connection with Downes' electrothermic apparatus. The ordinary cautery knives obtainable of instrument-dealers, usually intended for nose and throat work, are entirely



FIG. 353.—DOWNES' CAUTERY KNIFE (CURVED).



FIG. 354.—DOWNES' PLATINUM DOME.



FIG. 355.—DOWNES' CAUTERY KNIFE (STRAIGHT).

too fine and delicate and not at all adequate for this work. The dome-shaped cautery is used for the purpose of searing large surfaces, especially after curetment and after completing the amputation of the cervix by the cautery knife or loop.

A very useful and almost indispensable instrument in this operation is Sims' expanding reversible volsellum forceps, which is passed closed into the cervical canal and when the handles are brought together the tenaculum points are reversed and separated, thereby hooking firmly into the cervical or uterine walls on either side, giving the operator a very firm, secure hold of the uterus. This tenaculum

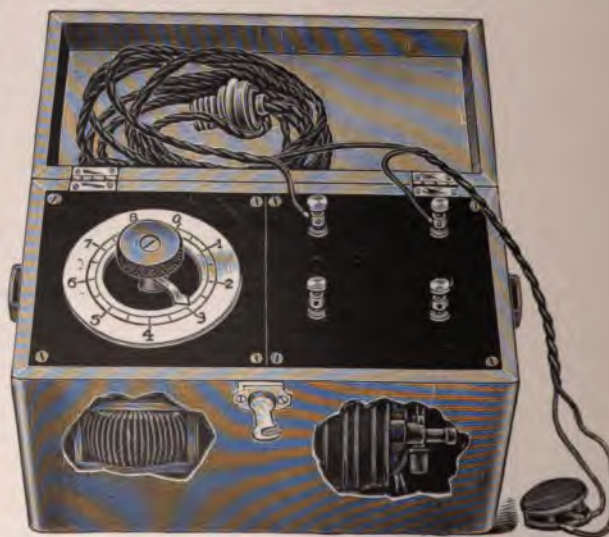


FIG. 356.—CURRENT TRANSFORMER FOR DOWNES' APPARATUS.

culum forceps has the further advantage over all other instruments of this character that it does not interfere with the work on the cervix, as its points are concealed within the uterine canal, thus permitting the application of the knife to the whole exterior surface of the uterus.

In order to prevent the heated metal portion of the knife or dome from inflicting burns on the vulvar or vaginal tissues, Byrne has recommended wrapping them with thin flannel close up to the platinum tip. The writer has found asbestos paper far preferable for this purpose, as it will not become scorched or burnt and forms a much better insulation for these exposed parts.

Preparation.—The preparation does not differ from that practised for other operations. The diseased parts should be cureted with a sharp spoon curet, and then before the cautery is applied the wound surfaces are thoroughly dried and all oozing checked. This may be accomplished by the application of styptics, as advised by Byrne, or preferably by gauze pressure. The bleeding points can then be seen and rapidly seared by the cautery heated to a dull red. At a bright red heat the cautery will fail as a hemostatic agent, and special care is therefore necessary never to have it heated beyond a cherry-red color. The cautery knife heated beyond this point will cut through the tissues just the same as a sharp scalpel, leaving a freely bleeding surface. In order to keep the knife at a dull heat it should invariably be first placed against the tissues we wish to cut before the current is turned on; the cut surfaces will then be perfectly dry and charred. As soon as the knife is removed it will at once turn bright red unless the power has been turned off. The full hemostatic effect of the cautery and complete exsiccation and charring of the tissues can only be obtained by the dull heat at which the instrument should be maintained during the whole operation. The searing of large surfaces can be just as easily and much more rapidly accomplished by the thermocautery, especially with a large blunt-shaped burner at a dull heat, although it is rather more difficult to regulate the proper intensity of heat in this instrument than with the galvanocautery, and this is probably the reason why Byrne has disparaged its use for his operation. With a little experience in the use of this instrument and the proper protection of its long metal tube leading to the platinum tip, it can be made to do good service, particularly for searing larger surfaces.

Operation.—The operation is best described by Byrne himself:¹ "An expanding double tenaculum forceps was passed well up the cervical canal, and when opened the uterus was so firmly held that any degree of traction could be steadily maintained. A circular fissure close to the vaginal insertion was next made for the reception of the platinum loop, the cautery knife being directed upward and inward. The wire being now adjusted and firm traction kept up, the loop was contracted at

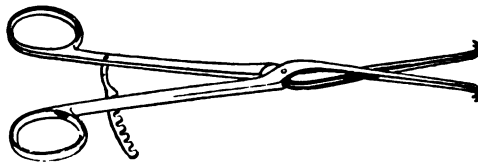


FIG. 357.—VOLSELLUM FORCEPS TO BE APPLIED WITHIN THE CERVIX.

¹ Byrne, John: Trans. Amer. Gynecol. Soc., 1891, vol. xvi, p. 172.

proper intervals (tightening the slack, merely) until the part embraced was severed. A sharp curet was next passed within the uterine cavity and the latter was thoroughly scraped out. Sufficient space having thus been made for another electrode, but having a larger cauterizing area, the interior was gone over so as to remove or destroy all softened or diseased tissue with which it might come in contact. The cavity was now sponged out very carefully and a tampon soaked in acetic acid and tannin applied for a few minutes so as to prepare the part for the next and perhaps the most important step of the operation. A dome-shaped cautery instrument brought to a cherry-red heat was applied to the excavation in every part, and when withdrawn the cavity was sponged out, dried, and again cauterized until the parts were completely charred and black." He further stated: "I have occasionally modified the proceeding just described by continuing the dissection of the cervix from the bladder, rectum, and lateral connections, as in vaginal hysterectomy, and completing the amputation with the cautery knife instead of the loop."

Byrne in all his writings on this subject emphasizes the importance of thorough and repeated cauterizations of the wound surfaces and edges from which cancerous material has been removed, regarding it as the "*best safeguard against the recurrence of the disease*." He thinks that "there is hardly any doubt that the developmental activity of the cancer cells or germs, in certain stages and under certain conditions, may be arrested or permanently destroyed by a degree of heat much below that which would be detrimental if not destructive to normal tissues"; he is certain that "the thermal agent exerts some modifying influence on pathologic processes much beyond and deeper than the surface actually cauterized, hence the importance of repeated applications, so that every spot suspected of contamination may be thoroughly charred."¹

Byrne's results, especially the freedom from local recurrences, would seem to justify the above conclusions. The most remarkable feature of this operation, when compared to other operative measures, is unquestionably the absence of vaginal recurrences. Byrne says:² "I have never known an instance of relapse in which the disease has returned to the part from which it had originally been excised. I have repeatedly observed the reappearance in the fundus, ovaries, and some of the adjacent tissues, but I have never known a single instance in which the disease has reappeared on or very close to the cauterized surface from which the cervix had been removed by galvanocautery." This same immunity from local recurrence is claimed by other operators using the galvanocautery, such as Pawlick, More Madden, and others,³ so that Byrne's experience seems by no means exceptional or singular. In this respect the cautery method seems to have a very decided advantage over all other operative procedures where local recidives are the rule, Winter⁴ having observed 54 in 58 cases. This fact certainly bears out Byrne's assertion

¹ Byrne, John: "A Digest of Twenty Years' Experience in the Treatment of Uterine Cancer by Galvano-cautery," Trans. Amer. Gynecol. Soc., 1889, vol. xiv, p. 79.

² *Ibid.*, 1888, p. 188.

³ Lomer, R.: "Zur Frage," etc.

⁴ Winter, G.: "Ueber Recidive des Uterus Krebses," Zeits. für Geb. u. Gynäk., 1893, Bd. xxvii, S. 121.

that the influence of the cautery extends beyond the actual field of operation, carrying destruction to cancerous elements deep into the tissues, and therefore doing much more radical work than can be accomplished by the use of the knife and scissors under the same conditions.

Byrne's experience covers 367 cases extending over a period of twenty years without a single operative death; 140 of these were carcinoma of the cervix; in 219 cases both cervix and body were involved, and in only 8 cases was the disease confined to the corpus uteri; 151 cases were lost sight of during the first year; there remained, therefore, 216 cases of which the subsequent history is known. Of these 19 remained free from the disease from ten to eighteen years, 22 for five years or more, and 93 for two years or more. Thus 19 per cent. were free from recurrence for five years or more, and over 43 per cent. for two years and over.

While these results may not equal those obtained by the present methods of operating, they nevertheless cannot fail to attract attention even now when we consider that the operation is practically a minor one, compared with the radical methods now in vogue, unaccompanied by any operative mortality. That the success obtained by Byrne is mainly due to his very thorough cauterization cannot be denied, as the simple high amputation of the cervix with knife and scissors as practised by Schröder, Reamy and others, could not compare with the results following the Byrne method. The singular freedom from local recurrences is also a distinctive feature of the Byrne operation and cannot be claimed by any other method in which the Byrne principle—thorough cauterization—does not play an important rôle. This practical assurance against local recidives by the thorough application of the cautery as practised by Byrne is a matter of sufficient importance in itself to recommend it to the careful consideration of the modern operator, who may employ it profitably in connection with the more radical procedures now in use for the cure of cancer of the cervix.

It is this feature particularly that induced the author to give this method a trial, not in the original form as practised by Byrne, but in connection with vaginal hysterectomy. Byrne admitted in his discussions that while recurrences in the vaginal cicatrix were exceedingly rare, they did occur in the fundus uteri and appendages; it was therefore desirable while retaining the Byrne principle of thorough cauterization to go a little further than the originator of the operation did, namely, to extirpate those organs completely, thereby removing all foci in those organs which might later give rise to further growth of the neoplasm. To accomplish this in the manner practised by Byrne, the writer first amputated the cervix by his method, using the cautery knife in place of the loop, and after cauterizing the diseased surfaces thoroughly the body of the uterus with adnexa was removed by means of the electrothermic clamp of Downes. For this purpose an incision with the cautery knife is carried around the cervix, first carefully dissecting up the bladder, the edge of the knife being held obliquely in the direction of the cervical canal to prevent any injury to the bladder. During this dissection the assistant with a retractor draws the bladder wall away from the hot knife. Posteriorly the same

precautions are observed with regard to the rectum. The cervix is then slowly removed, being careful to keep the knife at a dull heat and never to turn the current on until it is placed against the tissues to be burned. In this manner all oozing is entirely prevented and a perfectly dry charred surface is obtained. After the cervix has been completely removed, the stump is gone over again and again with the dome-shaped cautery to insure as thorough cauterization as possible. With the index-finger the bladder is then pushed off the uterus until the peritoneal cavity is opened in front; this part of the operation is usually very easy, as the tissues are softened by the heat and easily separated. The opening is then enlarged by inserting the index-finger of both hands with the palmar surfaces directed toward both pelvic walls, making firm traction in either direction, so as to separate the bladder from both ligaments as far as possible. This accomplished, the bladder is steadily and firmly held out of the way and drawn against the symphysis pubis by a broad retractor given in charge of the assistant during the whole operation. Douglas' cul-de-sac is then opened in a similar manner and both broad ligaments exposed. After packing off the abdominal contents by gauze pads inserted anteriorly and posteriorly into the pelvis, Downes' clamps are then applied on one side, usually in two sections, first above on the infundibulopelvic ligament, and then to the base of the ligament as far out against the pelvic wall as possible, the tissues thoroughly boiled, and then the ribbon thus formed cut through. After waiting a minute or so to make certain that the ribbon remains dry, the same procedure is repeated on the other side and the uterus then removed with its appendages. The necessary precautions against injury of adjacent structures by the heat are, of course, carefully observed, not only by applying the shield around the clamp, but further enforced by putting protecting pads around the field of operation. The large broad Downes clamp should always be used in this operation, as the smaller forceps is scarcely sufficient protection against bleeding, the narrow ribbon often opening up directly after the clamp is removed and requiring ligation of the bleeding vessels; while the larger broad ribbon rarely gives any trouble. Careful attention should be given to the oiling of the clamp surfaces, as neglect in this matter frequently causes a baking of the boiled tissues to its surfaces, thereby preventing the formation of the desired ribbon and resulting in free hemorrhage. If no bleeding is observed for a period of one minute, the stump can safely be dropped and no fear of hemorrhage need disturb the mind of the operator. The pelvis is now carefully cleaned out and packed off with gauze, another piece of gauze inserted in the vagina completing the operation.

The most striking feature of the convalescence of the patient after the operation is the entire absence of all pain, unless the vulva has been cauterized, an accident which with proper precaution should not occur. The convalescence is most ideal and quite a revelation to the operator whose experience in vaginal hysterectomy has been limited to clamps or even ligatures.

The procedure just described has been considerably modified, as there seemed no special advantage in amputating the cervix first by the Byrne method when it is

intended to remove the uterus entirely. Now the cervix is only cureted with a sharp spoon curet until all necrotic tissues are removed and the bleeding surfaces cauterized sufficiently to control all oozing. By means of the cautery knife the vagina is then incised entirely around the cervix, being careful to work in healthy tissues at a considerable distance from the diseased area. While making traction upon the cervix by means of strong volsellum forceps the dissection is carried up carefully between the bladder and uterus until the peritoneum is reached, which is opened by scissors. Posteriorly the same means are used to open Douglas' pouch, and then the lateral vaginal attachments are burned through, always keeping the knife at a dull heat to avoid oozing and to char the tissues as they are cut through. The bladder is then widely separated from the uterus and broad ligaments by inserting the two index-fingers and making lateral traction. The fundus uteri is then seized with volsellum forceps and dragged down into the vagina, while a broad retractor in the hands of an assistant holds up the bladder against the symphysis pubis and well out of the way during the whole subsequent course of the operation. Ordinary heavy clamps are then applied to the whole broad ligament, first on one side, two or three usually being required on each side; the same procedure is then repeated on the other side, and the entire uterus with appendages removed. Thus far the operation is practically that of the old clamp method, with the difference only that all incisions and dissections are made with the cautery knife. After packing off the pelvic cavity very carefully with gauze pads, the upper clamp is seized, the broad ligaments put on the stretch, and a Downes electrothermic clamp is applied externally to it and the tissues cooked until a good ribbon is obtained. The Downes clamp is then removed and the ribbon cut through, releasing that one clamp; the next is treated in the same way, until finally all the clamps are removed and both ligaments have been thoroughly boiled by the electrothermic clamps. The sacro-uterine ligaments and the tissues posterior to the uterus have, of course, also been included in the clamps and subjected to the cooking process.

The application of the ordinary clamps and the removal of the uterus first before resorting to Downes' instruments gives the operator this distinct advantage—that the field is under better view and control, and by using the clamps on the broad ligaments as handles, he can expose a larger portion of the ligaments and get a better bite with the Downes instruments than would be possible if he applied the latter while the uterus is still *in situ*. Particularly is this the case with the base of the ligaments or parametria, the extensive removal of which is of the greatest importance for good results.

This does not complete the operation—in fact, it is at this stage that the Byrne principle of thorough cauterization is applied. While the broad ligaments and parametria have already been subjected to an intense heat by the electrothermic clamps, they are now, at least the lower portion of them which were attached to the cervix, gently grasped with forceps and, after the surrounding structures have been thoroughly protected with pads, completely seared and charred by the use of the

dome-cautery. It will be seen, therefore, that not a single structure in this operation from which extension of the disease might occur escapes exposure to heat sufficiently intense to insure destruction of all cancer elements, not only in the parts directly treated, but probably for some distance beyond. Particularly are those tissues, the parametria to which the disease elements are carried at its earliest stage, subjected to this thorough and repeated cauterization for which Byrne so insistently pleads as the best safeguard against a recurrence of the neoplasm. At no stage of the operation could there be the least chance of implantation, as all the cancer cells are no doubt destroyed by the heat within the field of operation, and all avenues of absorption effectually closed and seared by the boiling process and finally the charring by the cautery.

The final steps of the operation, after thorough cleansing of the pelvic cavity and vagina, are the grasping of the bladder peritoneum anteriorly and the peritoneum of Douglas' pouch posteriorly, and uniting the two surfaces by a few catgut sutures, closing the pelvic cavity, leaving sufficient space on either side along the charred stumps of the parametria to insert an iodoform gauze drain. The vagina is then lightly packed with iodoform gauze. The vaginal gauze is usually removed on the second or third day, while the pelvic drains are left for four or five days.

The operation seems to the writer well fitted to take the place of Byrne's, because it conforms better to our modern views of the treatment of cancer, although it still retains the feature to which Byrne has attributed so much importance and for which he has argued on all occasions, namely, repeated and thorough cauterization. He has said on several occasions that it is immaterial in what manner the diseased cervix is removed, provided the operator follows it up immediately by the energetic and repeated application of the cautery. The Byrne operation thus modified and extended should have very little mortality, and with care and proper protection of the parts injuries of the bladder and other adjacent structures should be rare.

To what extent this operation will improve the ultimate results over those obtained by Byrne himself is a matter which the future must show.

CHAPTER XXIII.

VAGINAL HYSTERECTOMY.¹

BY FERNAND HENROTIN, M.D.

Definition.—Removal of the entire uterus, all incisions being made through the vagina.

Historical.—The writings of Soranus, Aetius, and Paulus Ægineta allude to extirpation of the uterus. The first case we find on record, however, is that of Berengarius of Bologna, who in 1507 is reported to have made a partial vaginal hysterectomy.

In 1560, Andreas A. Cruce, of Granada, Spain, seems to have made the first real total extirpation of the uterus for cancer. The manuscript describing his method is to be found in the Berlin and Göttingen libraries.

In 1600, Schenk,² of Grabenberg, collected and reported twenty-six cases, mostly partial.

In 1675, Volkamer, of Nuremberg, successfully amputated a prolapsed uterus.

In 1700, John Slevogt,³ of Jena, related that partial or complete vaginal hysterectomy had been performed by Bardol Widmann, Figuet, and others, and Blasius⁴ in the same year mentioned a case and described the operation. Following this came cases by Dietrich in 1745, and Carallini of Malta in 1768. Lauvariol, quoted by Baudelocque,⁵ was the first to perform the operation in France. Baudelocque says he taught and described the method. From 1801 to 1816 he performed twenty-three partial or total hysterectomies. The method of operating which he taught was artificially to prolapse the uterus, amputate above the disease, and in favorable cases to cut away the prolapsed organ and appendages.

In 1793 Osiander publicly described his method, but it would seem that he did not operate personally until 1801. The publication of Osiander's method and the success of his operation stirred the whole of Europe.

In 1794, Monteggia,⁶ of Leveno, was the first Italian to do hysterectomy.

In 1799, Alex. Hunter, of Dumbarton, Scotland, was the first in Scotland, and in 1805 Joseph Clarke,⁷ of Dublin, was the first in Ireland to perform this operation.

¹ I wish to make acknowledgment of the assistance received from Drs. S. C. Stanton and C. H. McKenna in the preparation of this chapter.

² Schenk, Joannes: "Observationum medicarum, rarum, novarum," etc., Francofurti, sumpt. J. Rhodii, 1600.

³ Slevogt, J.: "(Pr.) de utero per sarcoma ex corpore protracto, et postmodum resecto," (Jenae) lit. Krebsianis (1700).

⁴ Blasius, Gerardus: "Observationes medical rariores," Amstelodami, A. Wolfgang, 1676.

⁵ Baudelocque: *Recueil Periodique de la Société de Médecine*, Tome 4, 1798.

⁶ Monteggia, G. B.: "Annotazioni pratiche sopra i mali veneri," Milano, G. Galeazzi, 1794.

⁷ Clarke, Joseph: "Case of Successful Amputation of the Uterus," *Edinburgh Med. Jour.*, 1806, vol. ii, p. 419.

Up to this time no definite operation was recognized, and undoubtedly many of those mentioned were cases of procidentia or inversion, which were simply ligated.

In 1810, Wrisberg¹ delivered a dissertation on vaginal hysterectomy for the prize offered by the Royal and Imperial Academy of Vienna. He answered all questions, which were carefully prepared, and thoroughly covered the whole subject of the carcinomatous uterus in a most masterful way.

In 1813, Langenbeck² the elder, of Göttingen, performed the first deliberately planned vaginal hysterectomy in accordance with modern scientific methods. He removed in its entirety a carcinomatous, prolapsed uterus, by a process of enucleation, and tied all vessels with ligatures. The patient recovered and lived thirty years after the operation.

In 1827, Jules H. Hatin³ performed the operation, using a bivalve speculum and a traction forceps of his own invention, the teeth of which grasped the internal as well as the external surface of the vaginal portion.

In 1829, Récamier⁴ operated by his improved method, dividing the base of the broad ligament and ligating the uterine artery, and Roux⁵ reported two cases operated in the same way, all three being successful. In the same year Dubourg, of Auteuil, a small town near Paris, extirpated an entire carcinomatous uterus. He later emigrated to America, and settled in New Orleans, where he wrote a little memoir entitled "Extirpation of the Uterus."

In 1835, Kilian,⁶ of Bonn, quotes many cases of partial or total operations, and in 1841 Portal, of Palermo, mentions successful removal of the uterus for some sort of large tumor, the uterus being reported as deposited in the pathologic cabinet of the University of Palermo.

In 1848, Alexander von Kister, of Kasan, Russia, reports having performed seven successful total vaginal hysterectomies up to that time, he being the first to do the operation in Russia. In the same year Dieffenbach, in his "Operative Surgery," devoted an entire chapter to the "Exstirpatione der Gebärmutter," giving the various methods of operating up to that date.

In 1854, Reiche,⁷ of Magdeburg, reports seven total removals of the uterus for fungous carcinoma, with fatal results in each case.

In 1875, Hennig, of Leipzig, recommended the vaginal method before the

¹ Wrisberg, H. A.: "Commentatio de uteri mox postpartum naturalem resectione non lethali," Göttingen, ex off. Dieterichiana, 1787.

² Langenbeck, M. A.: "De totius uteri extirpatione," Göttingen, ex off. Dieterichiana, 1842.

³ Hatin, Jules: "Mémoire sur un nouveau procédé pour l'amputation du col de la matrice, dans les affections cancéreuses," Paris, Béchot, 1827.

⁴ Récamier, J. C. A.: "Recherches sur le traitement du cancer" etc., Paris, Gabon, 1829. Récamier et Dubled: "Nouvelles extirpations de la matrice," *Archiv. Générales de Médecine*, 1830, vol. xxiii, p. 403.

⁵ "Observations d'extirpation de la matrice d'après la méthode de M. le Professeur Récamier," *Archiv. Gén. de Méd.*, 1829, vol. xxi, p. 238.

⁶ Kilian, H. F.: "Operationslehre für Geburtshilfe," Bonn, E. Weber, 1835.

⁷ Reiche, F.: "Exstirpatio uteri," *Deutsche Klinik*, 1854, Bd. vi, Nr. 43, S. 484.

Association of Naturalists and Physicians, and exhibited a cancerous organ which he had taken out by Sauter's¹ method.

In 1878, the statistics of the result of Freund's² abdominal operation, based upon the cases of Schröder,³ Billroth, Czerny,⁴ and others, were published by Rokitansky.⁵ Of 95 patients operated on, 65 died by reason of the operation, and of the remaining 30 not one escaped without a recurrence of the disease. This induced many of his followers to abandon the operation. In the same year Czerny, of Heidelberg, took up the old Sauter-Récamier method of operation, and on August 12th removed the uterus through the vagina, applying ligatures to the severed vessels, his patient recovering. The example of Czerny in rehabilitating the old vaginal hysterectomy was soon followed by Schröder, Olshausen, Martin,⁶ Billroth, Fritsch,⁷ and others. The following year Billroth reported seven cases with five recoveries, and Schröder eight operations with seven recoveries. In 1880 Freund himself, at the International Medical Congress in London, compared the results of his operations with those done by the vaginal method, and intimated his belief in the latter as the operation of the future. Meanwhile Martin, of Berlin, had become one of the strongest advocates of the operation in all cases of cancer of the uterus, and proclaimed that the immediate mortality in the hands of experienced surgeons should not exceed 5 per cent. In the same year Mikulicz, who had been a strong follower of Freund's method, began to follow Czerny and Billroth, and reported five cases without a death, while Kaltenbach,⁸ of Freiburg, reported a large number of successful cases.

In 1881, Olshausen⁹ reported 6 successful cases of his own and collected in the literature 41 others, with 29 recoveries. Three of the cases were not carcinoma.

¹ Sauter, J. N.: "Die gänzliche Exstirpation der carcinomatösen Gebärmutter," etc., Constanz, W. Wallis, 1882.

² Freund, W. A.: "Zu meiner Methode der totalen Uterus-Exstirpation," *Centralbl. f. Gynäk.*, 1878, Nr. 12, S. 265.

³ Schröder: "Ueber totale Exstirpation des Uterus von der Scheide aus," *Allgemeine Wiener medicin. Zeitung*, 1880, Bd. xxv, Nr. 40, S. 423. "Ueber totale Exstirpation des Uterus von der Scheide aus," *Archiv f. Gynäk.*, 1880, Bd. xvi, S. 479-481. "Totalexstirpation des Uterus von der Scheide aus," *Zeit. f. Geburtsh. u. Gynäk.*, 1881, Bd. vi, S. 226. "Handbuch der Krankheiten der weiblichen Geschlechtsorgane," Leipzig, 1874, 1877, 1886, 1889, 1890.

⁴ Czerny, V.: "Ueber die Ausrottung des Gebärmutterkrebses," *Wiener medizinische Wochenschr.*, 1879, S. 1171, 1198, 1227 u. 1279.

⁵ Rokitansky, Karl V.: "Zur Totalexstirpation des karzinomatösen Uterus," *Wiener medizinische Presse*, 1882, Bd. xxiii, No. 21, S. 656.

⁶ Martin, A.: "Pathologie und Therapie der Frauen-Krankheiten, nach den in den Feriencursen für Aerzte gehaltenen Vorträgen," Wien and Leipzig. "Ueber vaginale Uterusexstirpation," *Berliner klin. Wochenschr.*, 1881, Nr. 19, S. 261. "Ueber vaginale Uterusexstirpation," *Centralbl. f. Gynäk.*, 1881, Bd. v, Nr. 8, S. 189. "Zur Technik der vaginalen Uterusexstirpation," *Centralbl. f. Gynäk.*, 1881, Bd. v, Nr. 5, S. 99.

⁷ Fritsch, Heinrich: "Zur Technik der Kolpohysterotomie," *Centralbl. f. Gynäk.*, 1883, Nr. 37, S. 585.

⁸ Kaltenbach, R.: "Amputatio uteri supravaginalis wegen Fibrom bei complicirender Schwangerschaft," *Centralbl. f. Gynäk.*, 1880, Bd. iv, Nr. 15, S. 345. "Ergebnisse der vaginalen Totalexstirpation," etc., *Zeitschr. f. Geburtsh. und Gynäk.*, 1894, Bd. xxx, S. 373.

⁹ Olshausen, R.: "Weitere Erfolge der vaginalen Totalexstirpation des Uterus und Modification der Technik," *Archiv. f. Gynäk.*, 1882, Bd. xx, S. 290. "Die abdominalen Myomoperationen," *Handbuch der Gynäk.*, Veit, 1897, Bd. ii, S. 607.

In the same year Thomas Keith,¹ of Edinburgh, performed the operation in the Edinburgh Infirmary, though he did not report it until ten years later.

By this time the operation of vaginal hysterectomy was growing rapidly in favor throughout the surgical world, and foreign operators began to follow the example of the great Germans. Practically all the work performed in Germany was done for the removal of the inverted or of the carcinomatous uterus. Occasionally, however, other pelvic affections, which involved the uterus, were treated by hysterectomy, though the rule was always recognized that success was to be expected only when the disease and the womb were small enough to allow of their being drawn through the vulva and when they were reasonably free from adhesions. These limitations to the operation, however, were removed, when from 1883 to 1890 Péan² and the French surgeons perfected the method of vaginal hysterectomy by morcellement.

To Doyen³ belongs the credit of initiating the classic method of hemisection, which today is the most perfect way of performing the operation in septic cases. Segond⁴ and Richelot,⁵ of Paris, and Jacobs,⁶ of Brussels, helped to make a most brilliant record for these French innovations.

From 1882 to 1895 the technic of abdominal hysterectomy was greatly improved. Transfixing pins and clamps and abdominal-stump fixations were gradually eliminated, and the results obtained became so satisfactory that it was again proposed that the abdominal should replace the vaginal operation, even for cancer. This belief gained ground because the remote results of vaginal hysterectomy were most disappointing, although the primary mortality was constantly being lessened. When the results obtained by Americans in abdominal hysterectomy became

¹ Keith, Thomas: "On Removal of the Uterus for Cancer," *British Med. Jour.*, Jan. 10, 1891, vol. i, p. 58.

² Péan: "De l'hystérectomie vaginale totale appliquée au traitement des tumeurs fibreuses multiples de l'utérus; morcellement des tumeurs; pincement définitif des ligaments larges; absence de fermeture du vagin." *Gaz. des Hôpitaux*, 1886, lix, p. 950. "Du morcellement appliquée à l'ablation totale de l'utérus dans certains cas de tumeurs fibreuses et cancéreuses," *Gaz. des Hôpitaux*, 1886, lix, p. 65. "Ablation des tumeurs fibreuses ou myomes du corps de l'utérus par la voie vaginale," *Gaz. des Hôpitaux*, 1886, lix, p. 445. "Indications de la castration utérine et de la castration ovarienne," *Gaz. des Hôpitaux*, 1886, lix, p. 1170. "Traité d'hystérectomie, et d'hystérectomie par la voie vaginale," Précédé d'une préface de M. Péan, Paris, 1889. "Quelques considérations sur le diagnostic et le traitement de certaines tumeurs de l'utérus et de ses annexes par la voie vaginale," *Gaz. des Hôpitaux*, 1891, lxiv, p. 689. "De l'ablation totale de l'utérus pour les grandes tumeurs fibreuses et fibro-cystiques de cet organe," *Gaz. des Hôpitaux*, 1892, lxxv, No. 66, p. 621. "De l'ablation des gros fibro-myomes interstitiels du corps de l'utérus par la voie périnéo-vagino rectale," *Annales de Gynec.*, 1894, vol. xli, p. 522. "De l'intervention chirurgicale dans les petites tumeurs de l'ovaire et de l'utérus," *Bulletin de l'Académie de Médecine*, 10 Juillet, 1883, p. 863. *Congrès Français de Chirurgie*, 1886, 2e session, p. 388.

³ Doyen, E.: "Technique Chirurgicale," Paris, 1897.

⁴ Segond, Paul: "Des plus gros fibromes justiciables de l'hystérectomie vaginale," *Ann. de Gynec.*, 1895, vol. xlv, p. 328.

⁵ Richelot, M. G.: "Hystérectomie vaginale suivie de mort," *Bulletins et Mémoires de la Société de Chirurgie de Paris*, 1885, new series, vol. xi, p. 746. "Sur le traitement des fibromes utérins par l'hystérectomie vaginale," *L'Union Médicale*, 1893, 3d series, vol. lv, No. 8, p. 85.

⁶ Jacobs, Charles: "Die späten Resultate der vaginalen Hysterektomie bei Affectionen der Anhängen im Vergleich zu denen der abdominalen beiderseitigen Ovario Salpingektomie," *Centralbl. f. Gynäk.*, 1894, Nr. 18. "Indications for Total Castration by the Vagina," *Trans. Amer. Gynec. Soc.*, 1895, vol. xx, p. 194.

evident, the latter procedure again came into vogue, and the old Freund method, modified by Ries,¹ Clark,² Werder,³ Wertheim,⁴ and others, is now the choice of many operators when patients are deemed strong enough to bear the operation.

The last historical item of interest concerning vaginal hysterectomy refers to the presentation of what is known as the "paravaginal incision" as a valuable adjunct to the proper performance of vaginal hysterectomy for malignant disease. This method of operating was devised by Schuchardt⁵ in 1893, and allows of a very much freer dissection of the parametrium, which is considered by most operators as the most important factor in securing ultimate success. It has not as yet been sufficiently adopted to allow of a definite opinion as to its probable value. Schuchardt himself, before his death, was said to have obtained 40 per cent. of permanent cures (five years' basis), with 12.2 per cent. primary mortality. Schauta had only 11 per cent. primary mortality, and speaks of the method in the most favorable terms. Regarding the primary mortality we may quote the following as applying to cancer of the cervix: Leopold⁶ 5.7 per cent., Hofmeier⁷ 10.8 per cent., Winter 7.5 per cent., Amann 4 per cent., Richelot 6.8 per cent., and Küstner 1.8 per cent. Olshausen had a mortality of 8 per cent. in all cases of vaginal extirpation for cancer, but was able to report a series of one hundred operations with only one death. The ultimate results, on a five years' basis, of vaginal hysterectomy for carcinoma of the cervix, by Schuchardt's method, are needed to determine the comparative value of the abdominal and the vaginal operations.

THE HISTORY OF VAGINAL HYSTERECTOMY IN AMERICA.

The extraordinary success which they have had in abdominal surgery seems to have made vaginal hysterectomy unpopular with many American surgeons.

The first vaginal hysterectomy of which we have any authenticated report was performed May 1, 1829, by J. Warren,⁸ professor of anatomy and surgery at Harvard University. It was performed as follows: He introduced into the vagina the first two fingers of the left hand, and with the right directed a pointed hook,

¹ Ries, E.: "Eine neue Operationsmethode des Uteruscarcinoms," *Zeit. f. Geburtsh. u. Gynäk.*, 1895, Bd. xxxii, S. 266.

² Clark, J. G.: "A More Radical Method of Performing Hysterectomy for Cancer of the Uterus," *Johns Hopkins Hosp. Bul.*, 1895, Nos. 52, 53, p. 120.

³ Werder, X. O.: "A New Operation for the Radical Treatment of Cancer of the Cervix," *Amer. Jour. Obstet.*, 1898, vol. xxxii, p. 289.

⁴ Wertheim, E.: "Ein neuer Beitrag zur Frage der Radikaloperation beim Uteruskrebs," *Archiv f. Gynäk.*, Bd. lxxv, 1902, S. 1.

⁵ Schuchardt, Karl: "Ueber die paravaginale Methode der Exstirpation uteri und ihre Enderfolge beim Uteruskrebs," *Monatschr. f. Geburtsh. u. Gynäk.*, 1901, Bd. xiii, H. vi, S. 744.

⁶ Leopold, G.: "Die operative Behandlung der Uterusmyome durch vaginale Enucleation, Castration, Myotomie und vaginale Totalexstirpation," *Archiv f. Gynäk.*, 1890, Bd. xxxviii, S. 1. "Zur vaginalen Totalexstirpation des Uterus und der Adnexe wegen schwerer chronischer Erkrankungen derselben," *Archiv f. Gynäk.*, 1895, Bd. lii, S. 523.

⁷ Hofmeier, M.: "Zur Statistik des Gebärmutterkrebses und seiner operativen Behandlung," *Zeitsch. f. Geburtsh. und Gynäk.*, 1884, Bd. x, S. 269. "Zur Behandlung und Heilung des Carcinoma uteri," *Sitzungsberichte der physikal.-medizin. Gesellschaft. Jahrg. 1890*, S. 12.

⁸ Warren, J.: "Extirpation of Cancer of the Uterus," *Amer. Jour. Med. Sci.*, 1829, vol. iv, p. 536.

which was introduced into the cervix for the purpose of drawing down the uterus as far into view as practicable; he then, with a scalpel in the right hand, made a circular incision around the neck of the organ, removing this, and with it about half of the body and a portion of the diseased vagina; a gush of arterial blood came at that moment, but was soon checked. The whole hand was now introduced and the remaining portion of the diseased tissue was removed with the assistance of a hook and a pair of tonsil scissors. The patient died on the fourth day.

In 1832, Herman and Werneberg, of Pittsburgh, Pa., removed nearly the whole cancerous uterus with successful results, and in 1834, John M. Esselman, of Nashville, Tenn., removed the inverted organ, also curing his patient. He repeated this operation successfully in 1843, this time removing an inverted fibroid uterus.

In 1848, A. L. Peirson,¹ of Salem, Mass., removed quite a large portion of a uterus, but this was in great measure accidental, as it happened during the excision of a polypus on an inverted uterus.

In 1850, Paul F. Eve,² of Nashville, Tenn., presented to C. D. Meigs, professor of diseases of women and children in Jefferson Medical College, Philadelphia, a pathologic specimen, consisting of the uterus of a negro woman which he had removed on April 16th of that year. A beautiful illustration of that specimen shows it to have been a uterus affected with cauliflower excrescences of the cervix. The patient died from recurrence of the disease three months later. The entire uterus had been removed.

In 1854, Geddings,³ of Charleston, professor of surgery in the Medical College of the State of South Carolina, removed an inverted uterus below a controlling ligature.

On May 11, 1877, E. Noeggerath,⁴ of New York, performed a complete, definitely planned vaginal hysterectomy. The anterior and posterior fornices were divided with the galvanic cautery and the bladder and rectum were separated from the uterus, after which a gum-elastic catheter was introduced from before backward and out of the posterior opening, and used as a carrier for the écraseur wire, which then separated the lateral attachments. This operation was really the first deliberate hysterectomy performed in accordance with modern methods.

Two more hysterectomies were done the same year, one by Janes,⁵ of Marshall, Ill., and the other by L. C. Lane,⁶ of the Medical College of the Pacific, San Francisco. In 1880, Blake,⁷ of Boston, reported a complete extirpation for inversion,

¹ Peirson, A. L.: "Polypus and Inversion of the Uterus—Ligature—Excision of a Large Portion of the Uterus—Recovery." *Amer. Jour. Med. Sci.*, 1849, new series, vol. xvii, p. 339.

² Eve, Paul F.: "Case of Excision of the Uterus." *Amer. Jour. Med. Sci.*, 1850, vol. xx, p. 395.

³ Geddings, E.: "Case of Total Inversion of the Uterus in which Extirpation of the Entire Organ was Successfully Practised." *Med. Examiner*, 1854, vol. x, new series, p. 692.

⁴ Noeggerath, E.: "Extirpation of the Uterus." *N. Y. Med. Jour.*, 1877, vol. xxv, p. 635.

⁵ Janes, J. M.: "Amputation of the Uterus with the Right Ovary." *Med. and Surg. Reporter*, 1878, vol. xxxviii, p. 26.

⁶ Lane, L. C.: "Enucleation of the Uterus for the Cure of Epithelial Cancer." *Pac. Med. and Surg. Jour.*, 1878-79, new series, vol. xii, Dec., p. 319.

⁷ Blake, John G.: "Cancer of the Cervix Uteri." *Bost. Med. and Surg. Jour.*, 1881, vol. civ, p. 339.

and in 1881, Clinton Cushing,¹ professor of gynecology in the Pacific Medical College of San Francisco, reported another case operated by Lane's method.

The modern operation, however, was more fully introduced to the American medical public through the masterly, classic article of Christian Fenger,² read before the Chicago Medical Society, November 7, 1881, and reported in the "American Journal of the Medical Sciences" in 1882. Fenger described his first case in all its details; this was performed September 19, 1881, and was a ligature operation, each broad ligament being gradually ligated from below upward, after the usual opening of the anterior and posterior cul-de-sacs. Fenger insisted on the necessity of closing the vaginal vault entirely and left a catheter in the bladder and one in the rectum.

In 1883, William H. Mays,³ of the University of California, reported a vagina, hysterectomy done after Lane's method for epithelioma of the cervix, and in November of the same year William C. Burke, Jr.,⁴ of Norwalk, Conn., reported another successful case to the New York Obstetrical Society. J. T. Stewart,⁵ of Peoria Ill., reports a case of procidentia operated February 13, 1883, by vaginal removal of the uterus, the operation being successful and the patient cured.

In 1886, Goodell,⁶ of Philadelphia, reported his second case of vaginal hysterectomy. He used the ligature on both broad ligaments, and closed the vaginal gap with wire sutures, leaving a small slit for drainage; but even then the propriety of this operation was questioned by Montgomery. All these operations were performed for carcinoma, inversion, or procidentia.

The first vaginal hysterectomy for suppurative pelvic lesions was performed in May, 1891, by the author, and was followed by a nine-day recovery. Vaginal hysterectomy for complex and suppurative lesions did not at first meet with active support; its first and most ardent supporter, after the author, was H. J. Boldt,⁷ of New York, who on May 21, 1894, reported fourteen cases. One of these operations was done for puerperal sepsis, and was the first of that kind in this country.

¹ Cushing, Clinton: "Removal of the Entire Uterus for the Cure of Cancer of the Cervix, with a Report of Two Cases," *Amer. Jour. Med. Sci.*, 1882, vol. lxxxiii, p. 421.

² Fenger, Christian: "The Total Extirpation of the Uterus through the Vagina," *Amer. Jour. Med. Sci.*, Jan., 1882, Art. 1, p. 17.

³ Mays, W. H.: "Case of Amputation of Cervix and Subsequent Excision of Uterus through the Vagina," *Western Lancet*, 1883, vol. xii, No. 7, p. 289.

⁴ Burke, W. C., Jr.: "Total Extirpation of the Uterus for Carcinoma," *Med. Record*, 1882, vol. xii, p. 644.

⁵ Stewart, J. T.: "Impregnation of a Completely Prolapsed Uterus—Abortion—Extirpation of Uterus and Ovaries, with a Large Section of the Posterior Wall of the Vagina—Recovery," *Med. Record*, 1883, vol. xxiii, No. 26, p. 701. "Extirpation of the Uterus and Ovaries with the Posterior Wall of the Vagina—Recovery," *Peor. Med. Month.*, 1883-84, vol. iv, p. 49. "Extirpation of Uterus and Ovaries," *Trans. Ill. State Med. Soc.*, 1883, p. 192.

⁶ Goodell, Wm.: Lecture: "Epithelioma of the Cervix in a Case of Prolapsus Uteri. Operation for the Removal of the Growth, with Opening of Douglas' Cul-de-sac, and Completion of the Operation by Removal of the Whole Womb," *Bost. Med. and Surg. Jour.*, 1886, vol. cxiv, No. 14, p. 313.

⁷ Boldt, H. J.: "Vaginal Extirpation of the Uterus and Adnexa in Pelvic Suppuration and Septic Puerperal Metritis and Peritonitis," *Amer. Jour. Obstet.*, 1895, vol. xxxi, p. 1112.

GENERAL CONSIDERATIONS.

Vaginal hysterectomy is a special method of technic for removal of the uterus, the advantages of which can only be made manifest by restricting its application to accord with reasonable indications.

The relative prognosis of vaginal and abdominal hysterectomy has heretofore been practically the same, if we contrast the statistics of large series of cases presented by operators who use one or the other method almost exclusively; but this does not lessen the strength of the argument that when all surgeons are trained equally in either operation, a proper selection of methods should result in a lower death-rate. Moreover, very recent work seems to indicate that abdominal sepsis, the one great danger of all intra-abdominal operations, may be almost entirely eliminated after vaginal hysterectomy by employing drainage with the sitting (Fowler's) position, to which after-treatment this operation can be so perfectly adapted.

The absence of visible scar, the lessened shock and mutilation, the practical impossibility of the occurrence of hernia, and the stronger, quicker convalescence after this operation, as compared with abdominal hysterectomy, would seem to make its use almost imperative in properly selected cases; so that, broadly speaking, we conclude that if a hysterectomy is practicable and equally indicated by either route, the propriety of ever performing it from above is questionable. The choice, however, is usually made by reason of the preference and personal experience of the operator.

After carefully investigating the various general characteristics of a given case and its pathologic indications, a surgeon accustomed to pelvic examinations may usually determine, by simple bimanual palpation, the best method to employ in operating, his decision being based upon the accessibility and mobility of the uterus, the thickness of the abdominal wall, the capacity of the pelvis, and the dilatability of the vaginal outlet.

The most important contraindication to the performance of vaginal hysterectomy lies in the presence of symptoms denoting abdominal disease above the pelvis. The greater safety obtained in modern abdominal work, combined with the knowledge that many pelvic troubles are frequently caused or complicated by diseases of organs higher up, has very properly popularized the suprapubic incision, both for operation and exploration, to such an extent that the field for vaginal celiotomy has materially diminished, until at last it has found its place as a special method of technic, adapted to carefully selected cases, and in this field it will prevail as one of the most admirable and life-saving procedures in the practice of gynecology.

The following may be considered a reasonable statement of the indications for vaginal hysterectomy:

It is the operation of choice for:

1. The removal of apparently normal uteri, where hysterectomy is adjudged advisable. This dictum needs no argument to sustain it. The average patient

is more quickly and better cured by the vaginal than by the abdominal method; the operation is safer and the mental shock less severe. These cases are not often met with in the practice of conscientious surgeons; almost all of them may be classed as follows:

(a) Neurasthenic and insane women in whom it is desired to arrest menstruation permanently for an ulterior effect;

(b) Patients suffering from irremediable, severe dysmenorrhea, or recurrent hemorrhages, discharges, and pelvic pain, which have resisted all other forms of treatment, and

(c) As a part of compound operations for procidentia.

2. Carcinoma of the uterus:

(a) When the patient is old and obese, and the disease slow in progress and not far advanced;

(b) When the disease is advanced and incurable, as a palliative measure to lessen hemorrhage and discharge;

(c) When by reason of weakness or some complication it is considered that the patient cannot bear a radical abdominal operation; and

(d) When the malignant process is limited to the body of the uterus, and the latter is situated low down in the pelvis and is small enough to be removed through the vagina without segmentation; as in certain cases of deciduoma malignum, carcinoma and sarcoma of the fundus, etc.

The advisability of ever performing vaginal hysterectomy for cancer seems constantly to be questioned in these latter days, since the elaborate and complicated modern pelvic evisceration has come in vogue, but gradually surgeons are beginning to realize that, after all, only very robust women, in whom the disease has not made much headway, can withstand these formidable dissections. Therefore many of us, some from mature reflection and others by reason of sad experience, reserve the complete radical abdominal operation for very favorable, early cases, and perform either vaginal or abdominal hysterectomies in a less radical but also less dangerous manner.

This view of the whole subject has become acceptable as a result of much careful observation by competent investigators, who report that more than one-half of all cases of carcinoma of the uterus show no glandular metastasis; that in a large majority of cases when the lower accessible glands are involved, the upper, inaccessible glands are also involved, and therefore the operation would be of no avail, and that in practically all cases the parametrium with the cervix is the seat of the disease. Therefore, in view of the danger of the very complete extirpation as taught by Jonnesco, Wertheim, Werder, Ries, and others, it seems logical in most cases to limit the operation to removal of the uterus with a vaginal cuff and as much of the parametrium as possible; and as this can be done with less risk, less danger of contamination, and better palliative results by way of the vagina, vaginal hysterectomy will remain as the most available operation for carcinoma uteri.

3. Fibroid uteri, which produce symptoms, in married women or unmarried women beyond thirty-five years of age, when the tumor is situated low down in the pelvis and is not larger than two fists.

4. Gangrenous or infected uteri embedded in a conglomerate mass of suppurative lesions of the adnexa, which are beyond conservative measures, as in puerperal infection and chronic disseminated pelvic abscess.

5. Miscellaneous forms of pelvic disease, where experience has proved that the operation is followed by cure, and where the danger of the operation is not out of proportion to the danger of the disease, as in aggravated cases of metritis or in chronic hydrosalpinx, with recurrent painful paroxysms, certain cases of tuberculous peritonitis, etc.



FIG. 358.—JACKSON SPECULUM.

The variation in the nature of the different lesions which are treated by vaginal hysterectomy has brought about corresponding modifications in the technic of the operation; these modifications are applicable to certain groups of cases and have been especially devised for them. In the following pages four modifications of the primitive vaginal hysterectomy will be described and the special indication for each form will be noted.

VAGINAL ABLATION OF THE UTERUS BY HEMISECTION.

This is a form of hysterectomy perfected by Pryor.¹ It is indicated for the removal of any non-cancerous uterus of about the normal size, and is especially adapted to cases of pelvic inflammatory disease in which it is desirable to remove both the uterus and the diseased appendages.

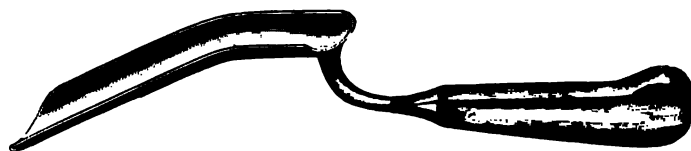


FIG. 359.—PRYOR'S WIDE TROWEL.
Used with women who have large vulvæ.

Pryor's² own description of the operation is as follows:

Appreciating the difficulty of ablation *en masse* in many cases, I have for several years exclusively practised ablation by hemisection. I divide my difficulties by splitting the uterus, and it is the operation which I always employ. It is the opera-

¹ During the preparation of this work our brilliant collaborator and my most esteemed friend, Dr. Pryor, passed away. I take pleasure in presenting his description of vaginal hysterectomy and ablation of the adnexæ by hemisection, not only out of regard for the work he has done for this volume, but because I consider it the most practical method of doing the operation. It refers especially to the proper treatment of non-malignant, suppurative, or puerperal cases.

² Pryor, Wm. R.: "The Technique of Vaginal Hysterectomy in Cases of Pelvic Inflammation," American Gynecology, vol. ii, No. 2, Feb., 1903, p. 102.

tion of election in all cases, whether associated with fibroid degeneration or not. By means of this procedure the time consumed in operation is not more than twenty minutes and the operation is always complete.

The patient should be in the old lithotomy posture, her legs flexed upon the abdomen by Clover's crutch. She should lie upon a table which will allow the operator to lower the head of the table so as to secure the benefits of Trendelenburg's position. After the operation is completed a final inspection of the stumps is necessary, during which the intestines will not prolapse into the vagina, if the head of the table is lowered.

The most important instruments used in vaginal hysterectomy are the Jackson speculum employed to retract either anterior or posterior vaginal wall (Fig. 358); Péan's long retractor (Fig.

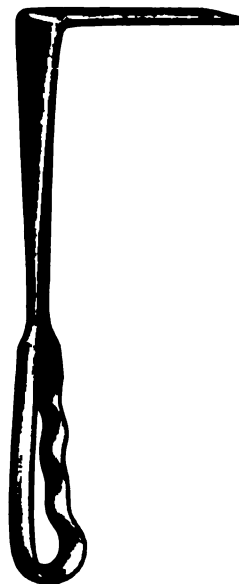


FIG. 360.—PÉAN'S LONG RETRACTOR.



FIG. 361.—PRYOR'S RETRACTING GROOVED DIRECTOR.
Of great service with soft, friable uteri.

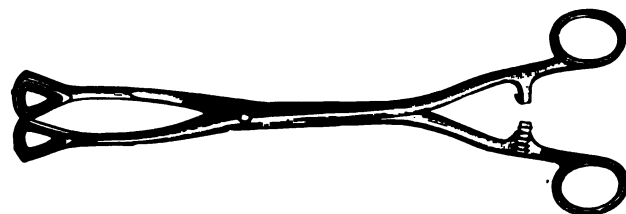


FIG. 362.—LUER'S POLYPUS FORCEPS.
The best for holding the adnexa.

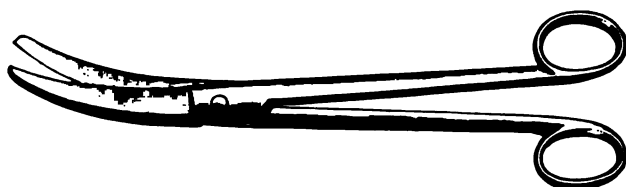


FIG. 363.—STOUT BLUNT SCISSORS USED IN VAGINAL HYSTERECTOMY.

360), which is straight, and Pryor's wide angled trowel (Fig. 359), especially valuable in women with large vulvar orifices. Another useful instrument is Pryor's retracting grooved director (Fig. 361), which is shown in actual use in Fig. 378. The ovaries and uterine tubes are best handled with Luer's polypus forceps (see Fig. 362).

A pair of stout blunt scissors (Fig. 363) are necessary to separate the tissues from the uterus as well as to divide the uterus itself.

In most cases the posterior crescentic incision is first made (see Figs. 364, 365), then the one anterior to the cervix. Between the adjacent ends of these two cuts I usually leave a small strip of vaginal skin. The incision outward from the sides

of the cervix (Ségon's) and along the anterior vaginal wall (Dührssen's)¹ or down the posterior wall (Henrotin's) I seldom employ, and when either is used it is in case there is much contraction about the vault of the vagina due to connective tissue. Henrotin's cut I also use in cases having deep peritoneal pouches, so that the lowest point of these may be drained. The incisions are preferably made with stout scissors. The use of the cautery knife is entirely unnecessary and often consumes valuable time. After the posterior cul-de-sac is entered, a methodic examination of the pelvic contents is made. In effecting an entrance into the pouch of Douglas some difficulty may be experienced. In all cases the vaginal skin is readily incised, and upon holding down the posterior flap the loose connective

tissue underlying the peritoneum comes into view. The operator holds the cervix by stout three-pronged forceps and attempts to enter Douglas' pouch by means of his finger. He may be dis-



A



B

FIG 364.

A, Shows the cervix exposed by anterior and posterior retractors and the place for the incision marked by a cross; B, the arrow shows the direction and position in which to open the posterior cul-de-sac.

appointed to find that the peritoneum is unusually thickened and stout and merely rips up from the posterior surface of the uterus before the advancing finger. When this occurs, the incision should be freely exposed and the peritoneum pulled down by a tenaculum and incised (Figs. 365, 366).

Beginners in this line of work may be undecided whether the presenting part is the rectum or thickened peritoneum. In all cases a small amount of serous fluid is found in the pouch of Douglas, and this will show through the peritoneum when the latter has been thinned by the dissection. There are, however, cases in which the posterior peritoneal pouch cannot be entered. In case an ectopic gestation

¹ Dührssen, A.: "Ueber eine neue Methode der Laparotomie (vaginale Coeliotomie)," *Berliner klinische Wochenschr.*, 1894, Nr. 29, S. 673.

has ruptured between the folds of the broad ligament, it may dissect the peritoneum up from the pelvic floor and from in front of the rectum. Again, a retro-peritoneal fibromyoma may lift the posterior peritoneum out of reach. In the former case the adnexa can be examined only after the bladder has been separated from the uterus; and in the latter the removal of the fibroid nodule will produce the desired breach into the peritoneal cavity. The posterior peritoneal pouch is readily entered either by simply incising the vagina and pushing the finger through the peritoneum or by the use of mouse-toothed forceps and scissors. The advantage is with the former method, as by means of the finger every step of the dissection can be felt. After exploration, if it is decided to proceed with the operation,

the incision is extended laterally and the opening is thoroughly stretched (Fig. 367). All adhesions posterior to the uterus along the middle line are



FIG. 365.—THE VAGINAL FORNIX CUT THROUGH, THE BULGING PERITONEUM IS NEXT INCISED, OPENING THE POSTERIOR CUL-DE-SAC.



FIG. 366.—THE PERITONEUM AT THE SIDE PULLED DOWN FOR INCISION IN ENLARGING THE OPENING IN THE POSTERIOR CUL-DE-SAC.

severed by the examining finger up to the fundus. No attempt is made to further separate the adherent organs at this stage. It cannot now be properly done and is a waste of time.

In case the patient has no disease other than a retroflexion, the incision in the vaginal posterior fornix should then be closed as in Figs. 368 and 369, leaving an opening in the middle large enough to accommodate a small drain (see Fig. 370, a); beneath this drain a firm pack, b, is inserted in layers, filling up the vaginal vault. Underneath this, again, a roll of gauze (Fig. 370, c) is placed in the manner shown, serving to complete the column which holds the cervix high up posteriorly and the

fundus forward. After seven days the pack is removed and another is inserted. A supporting tamponade is used for six weeks, after which a cradle pessary is inserted (see Fig. 371).

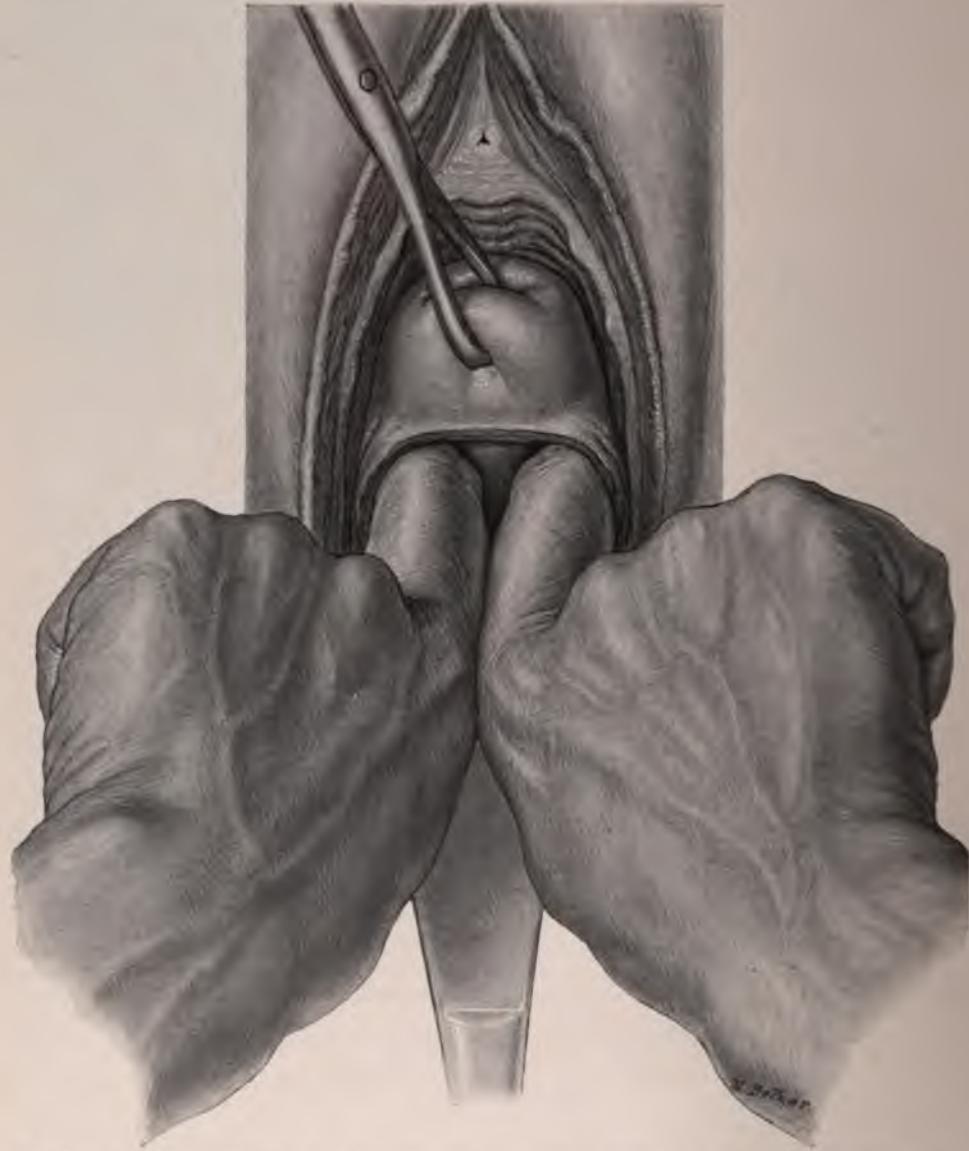


FIG. 367.—THE POSTERIOR CUL-DE-SAC OPENED AND THE TISSUES AT THE VAGINAL VAULT WIDELY SEPARATED OUT TO THE BASES OF BOTH BROAD LIGAMENTS.

It is not always necessary to take the uterus out, and occasionally a surgeon will be rewarded by finding, as in Fig. 372, a small uterine polyp whose removal will entirely relieve the troublesome hemorrhage from which the patient has been suffering.

Again, if after hemisection a small fibroid is found like that shown in Fig. 373, the operator after removal of the tumor then proceeds to close the uterine wound by a series of interrupted sutures and concludes a conservative operation.

It is more difficult to separate the bladder from the uterus. In certain cases I derive great assistance from my intrauterine traction forceps, which not only furnish a means of fixing a soft and small uterus, but also greatly aid the surgeon in differentiating the uterine from the vesical tissues. If the anterior tissues are severed too close to the external opening of the cervix, the dissection will be most difficult; but if made where the cervix joins the vagina, it will proceed with ease through the loose reticulated tissue which lies between the bladder and the uterus. Drawing down the uterus and holding up the bladder, the anterior cervicovaginal juncture is severed by means of the scissors (Fig. 374). This cut is not to be made close to the external os, but is above the dense cervical structure and in the loose pericervical tissue.

The fold at which the incision is made is easily seen when the uterus is shoved up. The incision is carried out laterally, following the contour of the cervix toward the posterior cut, but stops one-eighth of an inch from it on either side.

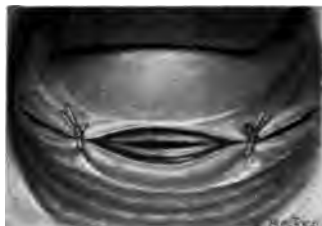


FIG. 369.—THE APPEARANCE OF THE WOUND AFTER TYING THE TWO SUTURES, LEAVING A CENTRAL OPENING FOR A DRAIN.



FIG. 368.—THE TWO SUTURES UNITING THE VAGINAL WALLS AT THE VAULT ON EITHER SIDE.

There are several ways in which the separation of the bladder from the uterus is begun. Either the assistant digs the short narrow Jackson retractor into the anterior cut with the edge planted hard against the cervix while the operator rotates the uterus and determines accurately the loose tissue between the uterus and the bladder, which he snips with scissors. or the edge of the closed scissors is laid in the cut and the tissues are shoved up by it in much the same way as a periosteum elevator is employed (Fig. 375). As this is done, the retractor draws the bladder further and further upward. In most cases but a moment is consumed in peeling the bladder up as high as the level of the internal os, and after that the fingers are employed to

complete the dissection. The dorsum of the finger is upward and the actual separation is effected by a sort of rubbing motion of the palmar surface; the bladder is rubbed off until the peritoneum is reached, when the vesicovaginal pouch is opened. Here, as posteriorly, the peritoneum may be found so thick as simply to peel up ahead of the entering finger. This can readily be determined and then the peritoneum is to be pulled down and cut by scissors. As a posterior retractor I employ the short, broad speculum of Jackson and a somewhat narrower instrument to hold up the anterior vaginal wall. Up to this stage the operator has made no attempt to separate more adhesions than will enable him to feel and, if necessary, to see the adnexa, or only sufficiently to determine the necessity for a radical

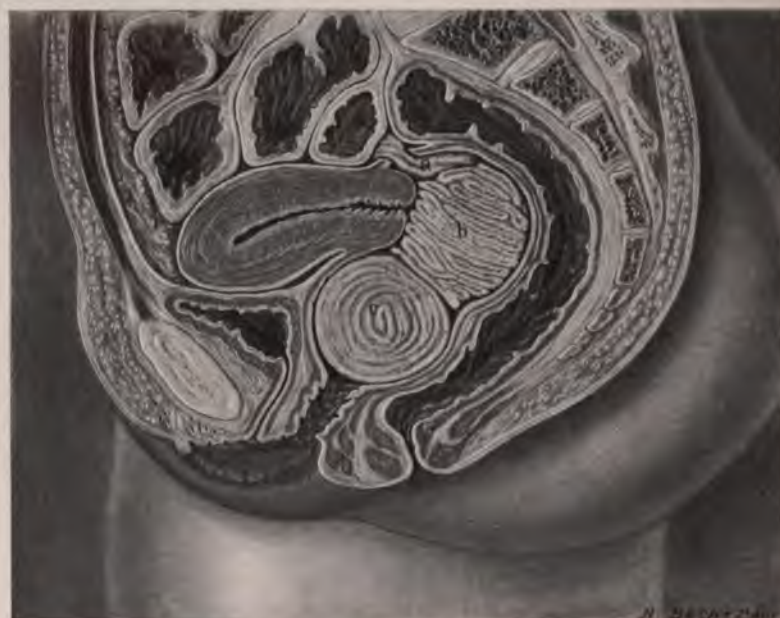


FIG. 370.—PRYOR'S OPERATION FOR RETROFLEXION.

Shows the uterus thrust up into ante-position. The gauze roll, a, projects into and drains the peritoneum. The cervix rests on b, while the roll c holds up the pack above it in the form of a stout column which serves to keep the cervix back.

operation. No attempt so far has been made to liberate the adnexa for removal. Upon the posterior vaginal wall a small artery, the azygos, has been cut, but except in puerperal and fibroid cases, is not sufficiently important to require even forcipressure. If desired, it may be readily secured. I have noticed very frequently, as I peel up the bladder, that a substantial vessel extends obliquely across the anterior face of the cervix from one uterine artery to anastomose with the inferior vesical; and, while I have never kept count of the side from which it springs, the fact has been impressed upon me that it most always arises from the left uterine artery. This aberrant trunk is very large in women who have been recently delivered and in fibroid cases. In all cases it should be secured and tied. After the opera-

tor has opened the posterior and anterior pouches of peritoneum, the incisions should be spread laterally. The posterior is so treated by means of the two index-fingers, while one finger will suffice to push the bladder from the sides of the uterus as well as the front (Fig. 367). This is done to make the rents in the peritoneum of equal size with the incisions in the vaginal skin. If the intestines tend to prolapse into the vagina, this may be prevented by introducing small gauze pads to which are securely attached stout linen lines, that they may be recovered, or by dropping the head of the table so that the diaphragmatic force will be overcome.

Hemisection.—This is an invariable, not an occasional, step in the operation. After the anterior peritoneal pouch has been opened, two pairs of bullet forceps, or vulsellæ, are made to grasp the angles of the external os and the cervix is drawn down, while the anterior retractor is used to hold the bladder up out of the way. A blunt sound is introduced to determine the direction and shape of the uterine cavity and the operator splits the anterior face of the cervix with scissors as high up as he can see it (Fig. 377). This will usually be up to the line of peritoneal reflection. While the assistants evert the edges of the severed cervix by rotating the forceps slightly outward, the operator seizes the cervix upon each side of the apex of the cut and forcibly draws downward and outward. It will now be seen that a portion of the anterior face

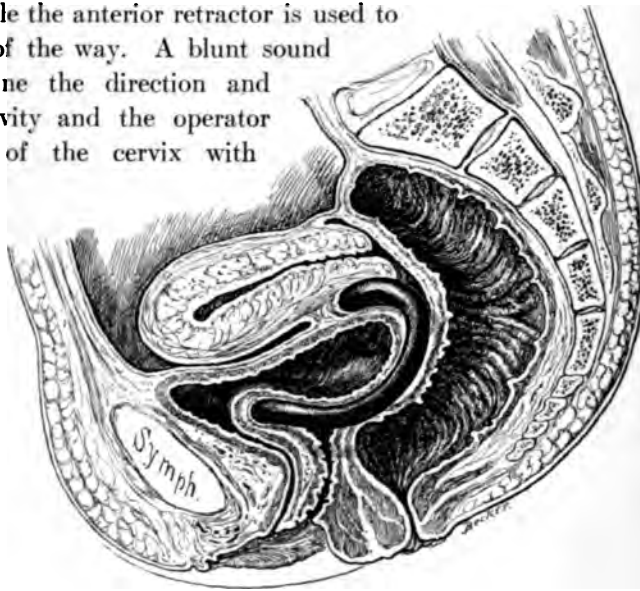


FIG. 371.—THE CRADLE PESSARY IN ITS RELATION TO BLADDER AND CERVIX HOLDING THE UTERUS UP IN ANTEPOSITION AFTER THE REMOVAL OF THE PACK.

of the uterus appears covered by peritoneum. This is split in the median line, its sides grasped by heavy toothed forceps as before, and more of the uterus pulled down beneath the bladder (Fig. 378). About three steps in this splitting of the anterior uterine wall will suffice, when the cornua uteri will appear beneath the anterior incision, often somewhat abruptly. The operator now runs his finger up behind the uterus, keeping in the middle line until he can see or feel its tip above the fundus. Withdrawing the finger, a retracting grooved director which I devised for this purpose is passed up until it shows beneath the anterior retractor (Fig. 378). The posterior retractor is then withdrawn. This grooved director is used not only to push back the perineum, but also

to draw the uterus forward. It is therefore particularly useful in large, soft uteri,



FIG. 372.—CASE CURED BY CONSERVATIVE HEMISECTION OF ANTERIOR UTERINE WALL AFTER THREE YEARS' ALMOST CONTINUOUS HEMORRHAGE.

Polyp undiscovered during three curettings. ($\frac{1}{2}$ actual size.)

the tissues of which tear under the toothed forceps. Into this director a bistoury or a pair of straight scissors is introduced and the posterior wall of the uterus is cut through. The uterus is now halved. The moment the uterus is split in two the bilateral fixity is done away with, and upon each side at least part, the uterine, of the mass becomes freely movable. The operator therefore has to deal with movable halves of the uterus, attached to which are the corresponding adnexa adherent to the broad ligaments or pelvic wall. Furthermore, the uterus, which up to this point has blocked the entrance to the pelvis, is no longer a hindrance. The right half is released from the forceps and is shoved up into the pelvis, and all retractors are withdrawn. Did I not leave a narrow strip of vaginal mucosa upon each side, when I shove up this half of the uterus, the uterine artery would be torn from its bed and its branches to the cervix broken. The operator then pulls the

left half of the uterus out of the vulva and introduces his left hand up to the thumb into the vagina. This enables him to manipulate the higher adhesions perfectly. If he feels that the omentum or intestines are attached to the uterus or adnexa, he can introduce retractors and separate the adhesions under the guidance of the eye. Whenever a tuborectal fistula is known to exist, that tube is handled last. After the left tube and ovary are rendered so movable that they can be brought beneath the bladder and into the vagina, these are released and with the attached half of the uterus are returned into the pelvis. The right half of the uterus is now drawn down and its adherent adnexa liberated by the right hand introduced as was the left. If the vulva is contracted by the formation of connective tissue, as in some old cases and in women past the menopause, it may be necessary to lubricate the hand

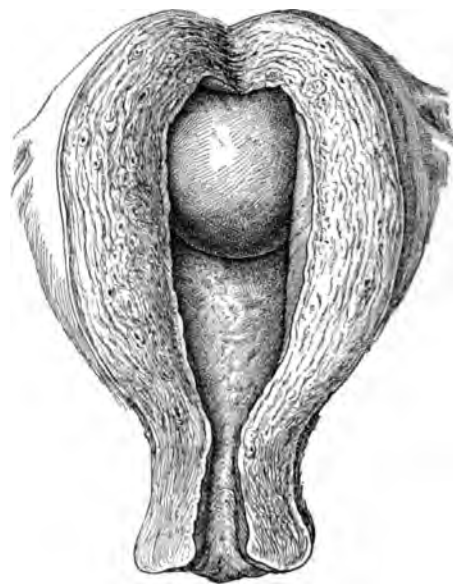


FIG. 373.—TYPICAL CASE FOR CONSERVATIVE ANTERIOR UTERINE WALL HEMISECTION.

The small tumor is a pure fibroma which occasioned excruciating dysmenorrhea. ($\frac{1}{2}$ actual size.)

with boroglycerid or sterile vaselin before it can be introduced. I have never found it necessary to split the perineum. Were I unable to make a complete operation without doing so, I would abandon it and perform laparotomy. Neither is it necessary to pass a bougie into the rectum. In fact, doing so conduces to its injury. All the tissues should be movable. After both sets of adnexa have been rendered movable, hemostasis is done. Up to this point the operator has not attempted hemostasis, but has bent all his energies to liberating the organs to be removed. So long as the uterus was pulled down the bleeding was trivial, but when one half is shoved up and during the liberation of the adnexa the bleeding is free. If the surgeon stands in ignorance of its cause and in fear of its importance and puts on forceps before the adnexa are liberated, he will probably find that he will be unable to secure the ovarian arteries outside the ovaries and will be compelled to content himself with an incomplete operation. As the operation was first done here it proceeded under preliminary hemostasis, the uterine arteries and then the broad ligaments being clamped and serially severed. It was no unusual thing to see patients with eight or more pairs of forceps sticking in the vagina and large portions of diseased adnexa left high in the pelvis. Rarely, very rarely, is a quarter of an hour needed to release and remove the tissues under a complete hemostasis. During this time the bleeding is parenchymatous only. The same manual dexterity which will enable the operator to free a pus focus from the iliac vessels through an abdominal incision, will more easily accomplish the same maneuver through the vagina. A forceps is first applied to an ovarian artery. One-half of the uterus is pulled out of the vagina and its adnexa brought forward. No retractors are necessary. The forefinger upon one side of the broad ligament and the middle finger upon the other, while the thumb powerfully doubles the uterus and holds the adnexa, converts the entire mass into a pedunculated one and the forceps is applied from above downward (Fig. 379). This forceps grasps the top of the broad ligament and the round ligament. It is locked and its handles removed. The tissues are cut to its ends and another forceps applied to the rest of the tissues, including the uterine artery; this is passed either from above downward or from below upward, close



FIG. 374.—THE INCISION ANTERIOR TO THE CERVIX.

to the cervix as may be most convenient (Fig. 380); the points of the two forceps lap; the one on the uterine artery being external to the one on the ovarian artery when put on from below or internal when applied from above. In this way splitting of the broad ligament is avoided and when the upper forceps is dropped, it will lie alongside the lower; by this means also the upper part of the broad ligament is folded over the forceps on the uterine artery and the latter one is kept from touching the bladder. Further, the weight of the upper forceps positively keeps the ovarian artery stump on a level with the uterine and at the vaginal vault (Figs. 381, 382).

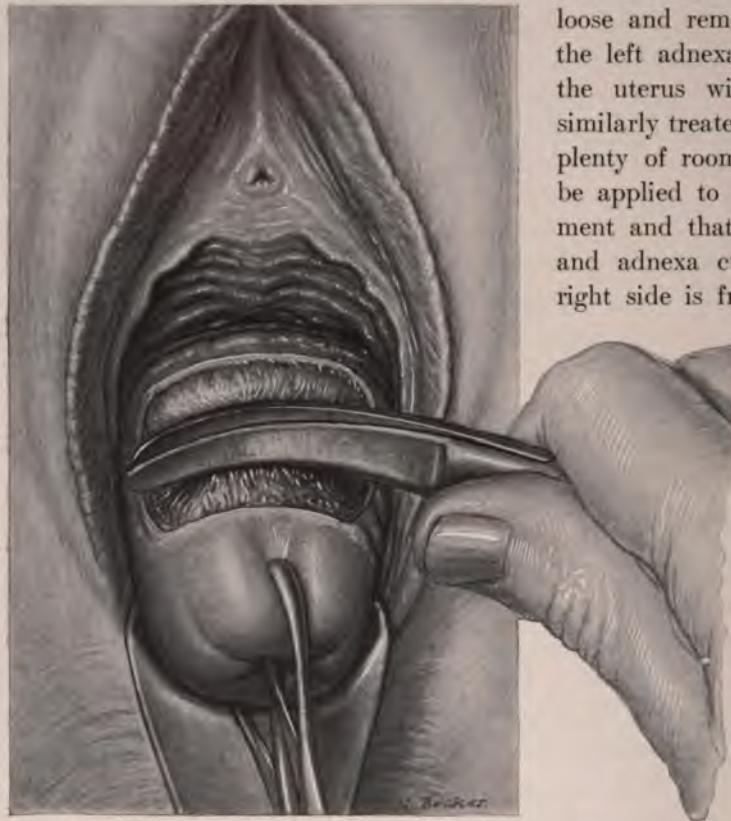


FIG. 375.—DETACHMENT OF THE BLADDER FROM THE CERVIX AND UTERUS BY MEANS OF THE CLOSED SCISSORS PUSHING UP THE BLADDER.

The left half of the uterus is cut loose and removed, together with the left adnexa; the other half of the uterus with its adnexa are similarly treated. In case there is plenty of room, the forceps may be applied to the left broad ligament and that half of the uterus and adnexa cut away before the right side is freed. Anterior and

posterior retractors are then introduced and lateral blades used to hold back the forceps and their stumps. Several gauze pads are passed into the pelvis to take up blood and discharges. The operator then makes a careful inspection of the stumps to iden-

tify the four cardinal vessels and to assure himself that there is no bleeding. The dressings are then made. In this more than in any other regard does my technic differ from that of the French surgeons. I have classified this operation as the formation of four stumps or pedicles which will slough and which must therefore be treated extraperitoneally. And the dressings must be so adjusted as to maintain the stumps outside the pelvis and in the vagina after the forceps are removed. Furthermore, this pelvic Mikulicz must be sufficient to isolate the field of operation from the peritoneal cavity and to absorb all discharges. Repeated

examinations have shown that the dressing also destroys all cocci, a matter of great importance in streptococcus infection, in which not only the uterus and adnexa are involved, but the retroperitoneal tissues as well. The dressings are applied in the following manner. I use Péan's narrow retractor to draw down the perineum and vagina and my narrow trowel to lift the anterior vaginal wall. The gauze pads are removed. The forceps are all drawn down carefully until their stumps are in the vagina. While holding each set in this position, a piece of iodoform gauze is adjusted between the forceps and the vagina, and by means of a long narrow retractor these two forceps are held firmly against the side of the vagina. The same is done upon the other side. Then, between the forceps so held, I introduce enough folded strips of iodoform gauze to create a stout bilateral pressure. The gauze between the forceps extends just above the tips, and in applying it the operator should see that at no point does a forceps touch the soft parts, particularly the intestine or the bladder (Fig. 383). A self-retaining catheter is now introduced; and the sphincter ani is dilated. This is done to lessen spasm of the levator ani, the sphincter's opposing muscle. I remove the forceps in forty-eight hours, and six hours later wash out the bladder and remove the catheter. The final outcome is an insignificant scar in the vaginal vault (Fig. 384).

I am frequently asked what position the ureters assume during this operation. I have determined this by repeated dissections. As stated, the operator should see that the bladder is entirely freed from attachment to the uterus. The relation of the ureter to the cervix is greatly modified by the hemisection. In applying the forceps to the uterine artery, the cervix is sharply drawn to the opposite side. This straightens out the curved part of the uterine artery and markedly increases the distance between the cervix and the point at which the uterine artery is in rela-



FIG. 376.—BISECTION OF THE UTERUS ON ITS ANTERIOR FACE.

The bladder is held up and out of the way by the retractor.

tion with the ureter. It will be noticed that no retractors are employed during this stage of the operation. They are only in the operator's way.

VAGINAL HYSTERECTOMY BY HEMISECTION AND MORCELLEMENT.

This is an operation designed for the purpose of removing an enlarged uterus the seat of fibroid tumor or other benign growth.

The operation is performed by a combination of hemisection and morcelle-



FIG. 377.—THE UTERUS IS AGAIN GRASPED BY FORCEPS AND DRAWN FURTHER DOWN AND BISECTED AS FAR UP AS THE PERITONEAL REFLECTION.

ment, that is, sectional removal of the center of the growth or of the uterus. The primary steps of the operation are the same as just described, except that, in many instances, the operator is not able to dissect upward and enter the free cavity, either anteriorly or posteriorly. It is important, just preceding the operation, to determine very definitely the exact topography of the tumor and its exact relation to the uterine cavity, the bladder, and the rectum, and the perfection, rapidity, and safety of the procedure will depend to a great degree upon these relations being constantly borne in mind. To secure the necessary knowledge, the use of the sound is practically indispensable, and the uterine, vesical, and rectal cavities should be carefully explored.

A grasp is secured upon each lateral angle of the cervix, and the anterior and posterior incisions made through the vaginal wall, as already described. The bladder in front and rectum behind are then dissected off from the tumor as high up as practicable. The direct, perpendicular incision of the anterior uterine wall is now begun and carried upward as far as is considered safe. When the cervix is in the posterior part of the vagina, and it has been ascertained that the tumor is anterior to the uterine cavity, the anterior wall of the uterus should be

incised, but when the cervix is forward or behind the pubis and the tumor behind the cavity, the posterior lip and wall are cut. In the first variety, great care must be taken to avoid the bladder, and in the latter, the rectum. A second pair of traction forceps is placed on the upper edges of the incision, either in front or back,

and renewed careful traction with cautious finger dissection usually results in bringing the whole mass lower down. This procedure is repeated until the body of the uterus is visible at the bottom of the vagina. This first part of the operation is often very arduous and its progress tedious, but practically never impossible. The important feature is always to cut in the middle line and never to cut until certain that the bladder or rectum is pushed away beyond the intended scope of the incision. When a space half an inch wide and one inch long, above the internal os, can be cleared on the body of the uterus, the morcellement may begin.

This procedure implies the excision of a section of one or the other edge of the central cut, with a view to lessen the transverse diameter of the whole mass. Its exact shape is really of little moment, provided that its general direction is centrally perpendicular to the sides of the pelvis. Various ingenious instruments have been devised to cut conical sections, and knives of all varieties have been recommended, but a long-handled, straight bistoury and sharp-pointed, heavy scissors (Fig. 385) will succeed in all cases. As soon as a longitudinal section in the body of the uterus, no matter how small, has been removed, without injuring the neighboring organ, there is really no excuse for failure. The edges of the cut made give a new and firm hold for other forceps, and by continuous traction, an adjoining part of the mass, at least equal to that which has been already removed, can certainly be drawn into the field of vision. The excision of this will probably double the space at the disposal of the operator. If the operation is on a fibroid uterus, as soon as a small space on the anterior or posterior wall of the uterus has been



FIG. 378.—THE UTERUS IS NOW COMPLETELY BISECTED ON ITS ANTERIOR FACE AND HELD FORWARD BY PRYOR'S CURVED RE-TRACTING GROOVED INSTRUMENT; AT THE SAME TIME IT IS HELD WIDELY OPEN BY THE FORCEPS AT THE SIDE AS THE LAST FIBERS ABOVE ARE DIVIDED.

gained, by deepening the incision and forcibly everting its edges, a glimpse will soon be caught of the white, glistening capsule of the fibroid. It may

be a small nodule, in which case a double tenaculum usually can be forced between the edges of the uterine incision, the nodule seized, and, by a rotary motion, shelled out of its bed. Or, if it be too large, a thin longitudinal slice or wedge-shaped piece may be excised, which will make room for the removal of a similar por-

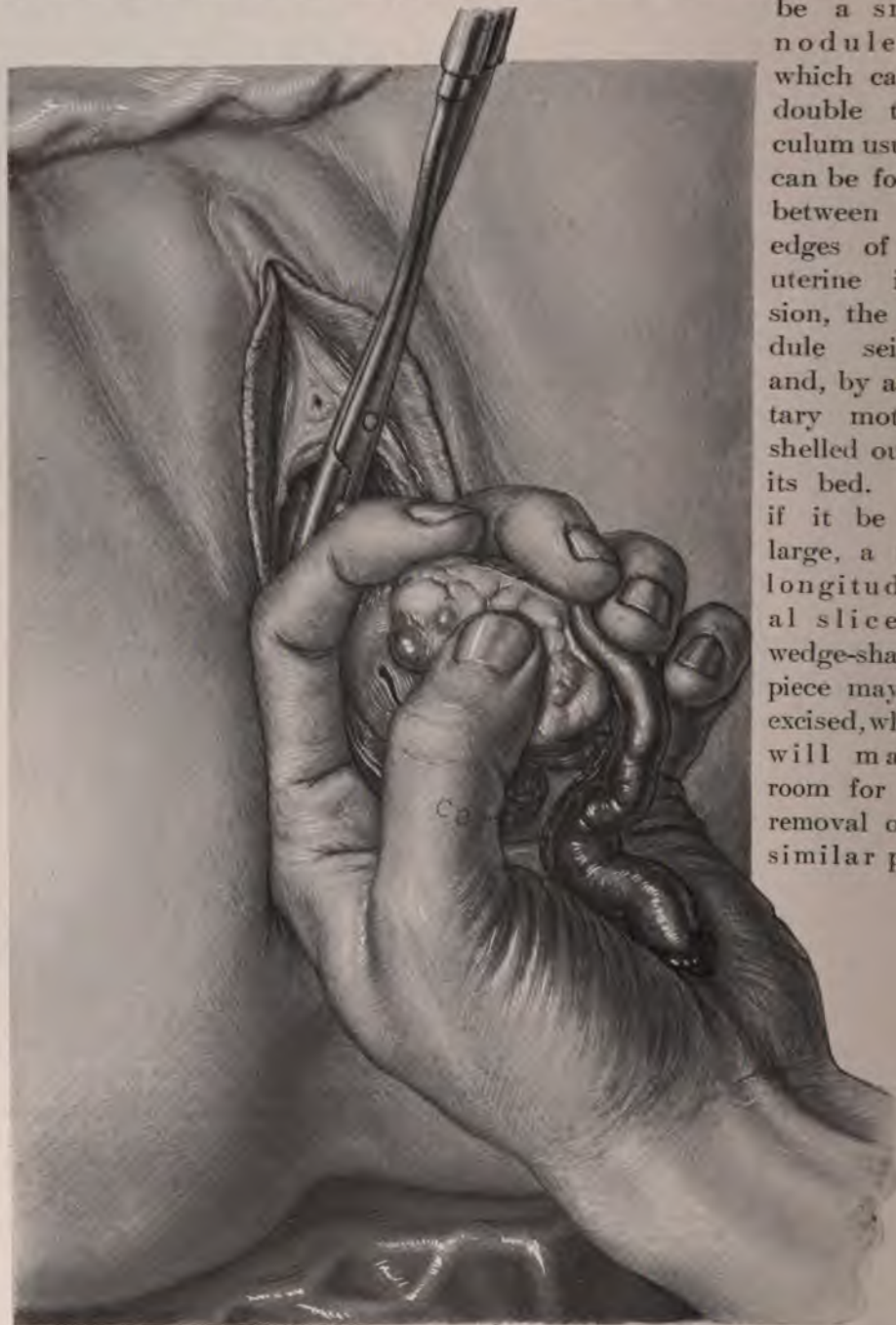


FIG. 379.—THE UTERUS HAVING BEEN COMPLETELY BISECTED IN ITS POSTERIOR AS WELL AS ITS ANTERIOR WALL, IS NOW REMOVED ONE HALF AT A TIME. THE FORCEPS ABOVE CONTROL THE OVARIAN VESSELS.



FIG. 380.—A SECOND PAIR OF FORCEPS WITH DETACHABLE HANDLES APPLIED LOWER DOWN THE BROAD LIGAMENT AS THE HALF OF THE UTERUS IS REMOVED.

tion from the adjoining tissues which replace it when downward traction is continued.

The whole process is one of decentralization, and its continuation will eventually

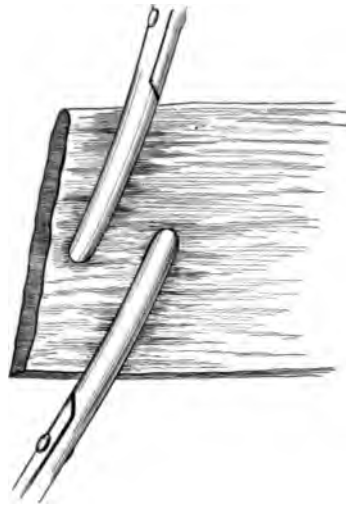


FIG. 381.—THE FORCEPS ON THE UTERINE ARTERY HAS BEEN PLACED FROM BELOW, WHILE THAT ON THE OVARIAN ARTERY HAS BEEN PLACED FROM ABOVE (Pryor).

It will be noticed that the points lap.

diminish the lateral dimensions until the whole mass is decreased in size sufficiently to engage in the vagina. With due care there is practically no hemorrhage; the traction on the cervix being continuous, lateral pressure on the pelvic wall prevents any bleeding from the small vessels distributed along the central lines of incision. At least four forceps should always be applied to the incision: two, the original ones, on the cervix, and two near the top. Traction should be continuous, and no portion should be entirely removed until a volsellum has been fixed on the immediately adjoining edge of the cut, to prevent that edge, with the uterus, from receding in the pelvis. Six or eight traction forceps or volsella should be on hand at every operation. No hemostasis is necessary until later, after the tumor has been removed and the fundus of the uterus has been delivered in the vagina.

A large tumor may be removed piecemeal in this way, without opening the peritoneal cavity at

all, although usually, as the anterior or posterior incision is prolonged, the cul-de-sacs are encountered and opened. Safety demands that the bladder and rectum be constantly kept out of the operating field by retractors, and that all dissections to gain room be made with the finger or the flat side of a blunt-end scissors, curved on the flat, and that the separation of adjoining structures and adhesions be made very closely against the tumor.

If median hemisection and slicing of the tumor and uterus have been begun on the posterior wall, it is advisable, as soon as sufficient of the tumor contents have been removed, to allow the anterior uterine wall to be dragged down in the field, also to split the wall, because the upper part of the mass often may be attacked



FIG. 382.—AFTER THE FORCEPS ARE APPLIED AND DROPPED DOWN, THE UPPER FORCEPS ON THE OVARIAN ARTERY DRAGS DOWN THE BROAD LIGAMENT SO THAT IT IS FOLDED OVER THE LOWER FORCEPS ON THE UTERINE ARTERY (Pryor).

from the interior of the uterine cavity through the anterior surface of the posterior wall, and the procedure thereby rendered much easier, as the parts are more accessible. As soon as either cul-de-sac is opened, the traction is slightly relaxed, the finger is introduced into the general cavity, and the exact location of the mass ascertained, while at the same time all intra-abdominal adhesions are removed by sweeping the fingers in all directions, keeping in constant and very close contact with the wall of the tumor or the uterus. When enough has been removed, the sides collapse by reason of the traction and the uterus and remnants of the tumor are extruded into the vagina, after which the remainder of the operation is simple and done on the lines heretofore suggested.

No time must be lost, however, for the lateral pressure on the vessels has now been removed, and although no large vessels have been cut at the sides of the uterus, profuse hemorrhage may take place from the vessels opening on the inner wall of the bed of the tumor. Clamps may be placed on either side of the uterus, the upper ovarian clamps being placed either distal or proximal to the adnexa, according to the desire of the operator, as some surgeons wish to preserve the ovaries. It is the writer's opinion that the oviducts should invariably be removed in hysterectomy, and he also removes the ovaries unless special objection is made by the patient. In spite of the opinion to the contrary expressed by some good surgeons, the writer's experience tends to demonstrate that, with removal of the ovaries, recovery is more complete, and he is



FIG. 383.—BOTH BROAD LIGAMENTS HAVE BEEN CONTROLLED AND THE CLAMPS ENVELOPED IN AN IODOFORM GAUZE ROLL, AND A SELF-RETAINING CATHETER DRAINS THE BLADDER.

furthermore convinced that retained ovaries and tubes occasionally become the seat of pathologic conditions which require their subsequent removal.

Vaginal removal of a fibroid uterus in properly selected cases is an ideal operation, a source of the greatest gratification both to patient and surgeon. It is a mistake to suppose that a predetermined vaginal hysterectomy for fibroid tumor precludes all conservatism. It frequently happens that quite large tumors may be removed *per vaginam* by hemisection and morcellement, the uterus being so slightly injured that it may be repaired by stitches. The operation thus becomes one of ideal conservatism.

VAGINAL HYSTERECTOMY BY MEANS OF THE CAUTERY KNIFE.

This is the preferable form of radical vaginal operation for cancer. The first steps of the operation differ slightly according to the position of the cancer.



FIG. 384.—THE VAGINAL VAULT SHOWING THE INSIGNIFICANT SCAR LEFT AFTER RECOVERY.

Carcinoma of the Body.—If the tumor is corporeal, the uterine cavity is curetted and packed with gauze, and the cervical canal is closed by sutures, the ends of which are left long, so that they may be used as tractors. The cervix is now drawn downward, and with the vaginal vault fully exposed, and the vaginal walls protected by means of retractors, the usual posterior and anterior colpotomy incisions are made, as noted already by Pryor (pages 771-777). The thermocautery or the electrothermic cautery knife is employed in making these incisions through the vaginal vault. No more than dull heat is used and the current is not turned on until the blade is in contact with the vaginal mucosa. After cutting through the vaginal wall, the dissection is continued posteriorly with the finger until the

peritoneum of Douglas' pouch is exposed. This is snipped with a scissors to the full width of the posterior incision. The posterior layer of the peritoneum is now sewed to the cut margin of the posterior vaginal wall with a running catgut suture, in order to control the oozing which is apt to occur if this measure is not taken. The bladder is separated from the cervix anteriorly by means of the finger or a blunt dissector, and the uterovesical pouch is opened either by tearing through the peritoneum or snipping it with a scissors. The anterior peritoneal opening is broadened to the full extent of the vaginal incision by introducing the fore-fingers into the vesico-uterine pouch and separating them to either side.



FIG. 385.—SHARP, HEAVY SCISSORS, ESPECIALLY USEFUL IN MORCELLATION.

Either point can be driven in the tissues, however hard.

The anterior surface of the uterus is now caught with a tenaculum (or by a series of tenacula) as high up as possible, and by means of traction upon the instrument and manipulations with the fingers the fundus is turned out through the anterior colpotomy incision into the vagina. The adnexa are now delivered first on one side and then on the other. Clamps are applied to the broad ligament from above downward outside the ovary. It is advisable to use two clamps—one for the ovarian vessels and

one for the vessels of the round ligaments. The broad ligament is divided to the inner side of the clamps, directing the incision toward the neck of the uterus. When this is reached, the uterine vessels are clamped from above downward and as close to the cervix as possible. The clamps should not include the bridge of vaginal tissue between the ends of the anterior and the posterior incisions. The lateral connection of the cervix is now



FIG. 386. CARCINOMA UTERI.

Patient in perfect health seven years after vaginal hysterectomy. Specimen opened to show disease.

cut through. The opposite broad ligament is now clamped and cut in a similar manner, thus freeing the uterus. After the uterus and adnexa have been extirpated, the stumps of the broad ligaments are seared with the cautery, and ligatures are applied to them outside the clamps, which are then removed.

The pelvis is now sponged clean, oozing points are controlled by means of ligatures or the cautery, or by both; and the margins of the anterior and the posterior

vaginal walls are united by suture, which includes the stumps and fastens them in the vaginal wound. A small opening is left in the median line, through which a strip of gauze is introduced for the purpose of draining Douglas' pouch.

The operation is more easily performed by omitting the use of the cautery, but the final results as to cure of the disease are not so good. As taught by Byrne, the influence of the heat of the cautery probably destroys the cancer cells even beyond the parts which are cauterized. The risk of implantation of cancer cells also is probably lessened when the cautery is freely employed.

Cancer of the Cervix.—In the case of cervical carcinoma the diseased area is first thoroughly curetted and cauterized. If possible, the area is covered in by uniting the healthy margins of the anterior and the posterior cervical lips. Under such conditions the succeeding steps of the operation are the same as those just described for carcinoma of the body of the uterus. If this is not feasible, a circular incision is made by means of a cautery knife in the vault of the vagina. This should surround the cervix and be at as great a distance from the cancerous area as it can be conveniently placed. The vaginal wall embraced in this incision is separated from the underlying tissue, and the anterior and posterior parts are sewed together over the cervix, completely isolating the diseased area. The vagina is now washed out with sublimate solution and the posterior and anterior peritoneal pouches are opened. The broad ligaments are clamped from below upward, one at a time. Care should be taken to keep the ureters out of harm's way by having the bladder well elevated by means of a long-bladed vaginal retractor. The clamps which catch the uterine vessels must be placed rather close to the cervix for the same reason. After clamping the uterine vessels on one side the base of the broad ligament is cut through close to the cervix, and another clamp is placed higher up on the broad ligament. The upper clamps may be directed further from the uterus and the one used for the ovarian vessels should grasp the broad ligament outside the ovary in order that the adnexa may be removed with the uterus. Three clamps will usually suffice on each side, one for the uterine vessels, one for the round ligament, and one for the ovarian vessels. After cutting through the broad ligament on the outer (median) side of these clamps, the uterus will be quite movable, being suspended by the pedicle formed by the opposite broad ligament. The clamping of the second side will be comparatively easy and may be carried out as has been described for the first side; or the uterus may be delivered into the vagina and the clamps applied from above downward. The stumps should now be seared with the cautery. This should be followed by placing ligatures to the proximal side of the clamps, as described in the operation for cancer of the corpus. The stumps are now sutured in the vaginal wound, provision being made for drainage of Douglas' pouch with gauze.

In cases of vaginal hysterectomy for cancer where pelvic adhesions or adnexal disease render the operation very difficult, the technic of Pryor already described may be used. It is never advisable, however, in a cancer operation to work through cancerous tissue for fear of inoculation metastases. Consequently, unless abdom-

inal celiotomy is contraindicated for some good reason, vaginal hysterectomy should not be used for complicated cases. If used at all, the method of Schuchardt or of Schauta would be most suitable.

**VAGINAL HYSTERECTOMY BY MEANS OF A PARAVAGINAL INCISION
(SCHUCHARDT'S OPERATION).**

This is the most radical form of vaginal hysterectomy for cancer. It was first recommended by Schuchardt, and has been further championed and improved by Staude¹ and Schauta.² The paravaginal incision gives free access to the parametrium, the complete removal of which is the main feature of the procedure. The paravaginal incision is the first step of the operation; it is started above, in the left vaginal vault, at about the level of the cervix, and carried forward through the left paravaginal and pararectal tissues, the left labium, the left levator ani and coccygeus, the cellular tissue of the left ischiorectal fossa, the skin of the perineum and of the lateral anal region back to the sacrum. The incision is made just enough to the left of the median line to avoid injury to the rectum and anus. It divides the pelvic diaphragm and exposes the vaginal vault and bases of the broad ligaments to easy reach. The hemorrhage from this incision should be immediately controlled by means of fine catgut ligatures. The next step of the operation is to circumsise the vaginal wall at the junction of the upper with the middle third of the vagina and dissect it off from the rectum and bladder. This cuff of vagina is then sewed over the cervix so as to shut off the cancerous area from the operative field. The ends of the ligatures employed for this purpose are left long and are used as tractors to control the position of the cervix. The cervix is now separated entirely from the bladder and ureters, and the vesicouterine pouch is entered. Douglas' pouch is opened and the dissection of the parametrium from the ureter and pelvic wall, the isolation and ligation of the uterine artery, etc., is begun. After the uterus and parametrium have been removed, the anterior and posterior leaflets of the peritoneum are united by suture and the paravaginal incision is closed. Vaginal drainage is used. For a more elaborate discussion of the operation the reader is referred to the papers of Schuchardt, Staude, and Schauta.

**MODIFICATION OF PRYOR'S TECHNIC, INCLUDING THE PLAN OF LIGATION
OF THE VESSELS, DRAINAGE, DRESSINGS, AND AFTER-TREATMENT.**

The very complete description of the operation for the removal of the infected uterus and pelvic organs, written by Pryor, should be supplemented by a description of what he termed the "pelvic Mikulicz," a method of packing the pelvis thoroughly with pads and slips of iodoform gauze inserted between the vaginal

¹Staude, C.: "Ueber Totalexstirpation des carcinomatösen Uterus mittelst doppelseitiger Scheidenspaltung." *Monatschr. f. Geburtsh. u. Gynäk.*, 1902, Bd. xv, H. vi, S. 863.

²Schauta, F.: "Die Berechtigung der vaginale Totalexstirpation bei Gebärmutterkrebs," *Monatschr. f. Geburtsh. u. Gynäk.*, 1904, Bd. xix, H. iv, S. 475.

wall and the clamps and between the clamps, and in the Douglas sac, beyond the edge of the forceps which project in the pelvis. This implies leaving the clamps *in situ* for forty to forty-eight hours. The Pryor instruments are capable of disarticulation distal to the lock and are less painful and troublesome than the usual hysterectomy clamps (see Figs. 380 and 383). The better way (and this is the only criticism which can be offered to Pryor's method) is to remove the clamps, after ligating the vessels, in the following manner: A stout curved needle with a large eye is threaded with a strand of No. 3 eight-day catgut, eighteen or twenty inches long, and the stump, grasped by each clamp, is ligated external to the instrument, beginning with the one nearest to the vulva or most easily reached. Care must be taken to perforate the broad ligament previous to tying the upper and lower edges especially, and a mattress suture back of the clamps is desirable. There is practically no trouble in the maneuver and the little time spent is of no consequence, as the anesthetic may be discontinued while ligating. Usually the ligature is never cut, but the operator goes from one clamp to the other, using what is practically a continuous suture, interrupted by knotting. As the ligature is tightened on the last section of each stump, the particular clamp which holds that stump is taken off by an assistant after the first loop of the knot is made and the second loop quickly brings it home. The same ligature is also used to whip the peritoneum over the stumps, and, if desired, to lessen the dimensions of the vaginal vault opening, in accordance with the necessity for more or less drainage space. In some cases only a small opening is left and a cigarette drain, no larger than the little finger, is left in; while in others when there is persistent venous oozing, after breaking up the adhesions the opening is left wide and a very complete packing of gauze applied, tight enough to exert pressure on the edges of the vaginal wound and the base of the broad ligament stumps. The packing consists of four (one inch wide and eighteen inches long) iodoform gauze strips, each twisted rope fashion, to the size of a lead-pencil; these put in place in bunches of five or six. This method makes their removal almost painless. Ligation of the vessels after clamping them is really the most simple way of hemostasis possible. It adds immensely to the comfort of the patient and is the safest way. I have used no other for several years; have never found any difficulty in the tying, and have had only one case of bleeding (and that of no seriousness), which was due to my hurry and not to the fault of the method. It is also better, in my opinion, to place three clamps upon each broad ligament, as ligatures not encircling so much tissue are more secure, while the manner of hemostasis just described prevents any splitting of the broad ligament. Proper ligaturing, *en masse*, is safer than ligation of the isolated vessel, provided it is done in the way described. Occasionally, when vaginal hysterectomy is performed, for a simple, non-septic disease, or after removal for limited carcinoma of the cervix, or a fibroid which did not need prolonged manipulation, the vaginal vault may be entirely closed without drainage, with the same catgut suture which was used to ligate the vessels or a new one. It is my opinion, however, that this should seldom be done, for reasons which will be made clear when

speaking of dangers and complications. After the operation is completed, a survey of the whole field is to be made to detect any oozing of importance which may have been overlooked. If all is well, a pad or a large dressing wrung out of hot sterile water, held by an attached tape, is placed in the bottom of the pelvis to restrain any tendency to prolapse of the omentum or intestines. The bladder is now catheterized, to detect blood in the urine, which, if found, probably indicates a wound of the bladder or of the ureter; following the catheterization the patient is thrown into the Trendelenburg position, the gauze pad is removed, and a last inspection is made; any bowel or omentum which may be clinging to the edges of the wound is gently loosened; and when the vault opening is perfectly clear, the gauze packing is applied, as above described. The catheter is never used again unless made necessary by retention or some bladder trouble. A pad wrung out of 1:8000 hot bichlorid solution is placed over the vulva, covered with oil silk or gutta-percha tissue, and kept in place by a dry pad and a T-bandage. These dressings are renewed after each urination and the wet pad changed to one wrung out of hot boric acid solution, after two and a half or three days. While the dressings are being applied, the patient is given $\frac{1}{30}$ of a grain of salicylate of eserine, hypodermically, and her stomach is thoroughly washed out, after which she is taken to her bed and *placed in the half sitting posture known as "Fowler's position."*

At the expiration of twelve to eighteen hours she is given a "2-4-8" enema:

Epsom salts.....	2 oz.
Glycerin.....	4 oz.
Warm water.....	8 oz.

which in practically every case liberates gas and often results in a bowel movement. The evening of the day following the operation she receives two one-grain calomel tablets, an hour apart, and the next morning a seidlitz powder, followed three hours later by a 2-4-8 enema. The same diet is given as after laparotomy, and the inner dressings are not touched until the fifth or sixth day, unless special indications arise. At that time she is placed in Sims' position and the rope-like strands of gauze are gently dragged upon, passing from one to the other, pulling on those which offer the least resistance and aiming to remove one-third of them entirely and cutting off the remainder, close to the vulva, when they are pulled out enough to lie straight. On the ninth or tenth day all the gauze is removed, the patient being again in Sims' position, and a new small packing of gauze is placed just within the lips of the incision. The next day she sits up; on the thirteenth day all packing is done away with and hot boric vaginal douches are given. If the patient is very anxious to do so, she returns home on the thirteenth or fourteenth day, otherwise she remains under observation at the hospital until the twentieth day.

DANGER OF THE OPERATION AND DANGEROUS COMPLICATIONS.

Injury to the ureters is the most serious operative risk of vaginal hysterectomy and is a great drawback to its popularization. Operators are not keen to report

the accident and many cases undoubtedly remain unmentioned in statistics. The accident has happened in my hands three times, the last two instances only a few months apart—this is in a series of several hundred cases, covering a period of sixteen years. As our technic improves this accident will undoubtedly occur less frequently, but it will probably remain an occasional mishap in the practice of even the most skilful. The ureter is either cut or clamped, ligated or torn. It is apt to be cut or clamped in operating for malignant disease, when the surgeon is endeavoring to operate wide of the disease and encroaches laterally too far upon the parametrium. It may be included in the ligature in the same way, when one endeavors to catch bleeding vessels without careful consideration of the position of the ureter. It is practically impossible to catch the ureter in a clamp held parallel to the wall of the vagina, and when seizing a spurting vessel due care not to include too much tissue with the vessel will usually avail. It is my opinion that most cases of injury to the ureter occur when separating the bladder from the lateral anterior surface of the uterus. After the vaginal mucosa is incised, it is customary to continue to drag down on the cervix. The bladder follows the uterine body, the vaginal mucosa is retracted, and if the lateral detachment is roughly made, without great care to obtain a cleavage very close to the uterus, the ureter may be dragged in the field and injured in its cystovaginal part, close to where it enters the bladder. Especially is this liable to happen when a dry gauze sponge is used to rub the bladder from off the surface of the uterus, while traction on the cervix is exaggerated; even if the fingers are already intra-abdominal if the lateral tearing or stretching of the anterior opening is done carelessly, while the uterus is in extreme downward traction, an injury may be inflicted upon the ureter. Therefore, to avoid the accident maintain the uterus immobile, and do not make downward traction while separating the bladder from its anterior surface. Occasionally a leak has sprung suddenly from the ureter, several days or even weeks after the operation, where large pus-sacs were not thoroughly removed. Such an accident is not always avoidable, but it emphasizes the importance of complete extirpation of the adnexa when septic. It is very seldom indeed that all pus-sacs and diseased tubes and ovaries cannot be removed by the Doyen anterior wall hemisection, or by the complete hemisection, as described by Pryor. Careful dragging down with ovarian forceps, placed upon the adnexa, combined with centripetal manipulation toward the vaginal opening and bimanual maneuvers, will bring within reach ovarian sacs or pyosalpinx of the most enormous proportions, which may even have to be bisected for easier extraction. Occasionally fibromata will migrate or extend post-peritoneally to the ureteral region and distort or displace this canal; injuries, however, can usually be guarded against if the capsule of the tumor is well marked, by careful enucleation or shelling out; when, however, as sometimes happens, this condition is accompanied by pelvic peritonitis and its accompanying adhesions and induration, this misfortune may occur in spite of the utmost precaution. The same liability, however, holds good under the same conditions if the operation is being performed abdominally. Injury to

the bladder or to the rectum may also occur, but the great majority recover without any special treatment beyond keeping the parts thoroughly cleansed. As a fistulous track often exists between the bowel and an abscess sac, when the latter is removed the opening in the bowel may communicate with the pelvis.

Hemorrhage.—The danger from this is practically *nil*, in all cases except those of advanced carcinoma. The vast majority of serious hemorrhages are the result of fear, haste, or unwarranted violence on the part of the operator, and, like post-partum bleedings, they are almost all limited to the practice of the inexperienced. Occasionally an experienced surgeon gets into trouble, but it is usually through haste or vanity, as when he becomes bold to rashness when operating in the presence of august company. A steady hand and a cool head, with good light and good assistants, three or four eight-inch forceps, and a little catgut will suffice to control any arterial pelvic hemorrhage after hysterectomy, whether abdominal or vaginal. Properly applied gauze packings will do the same for venous oozing. As stated by Byron Robinson, the most common origin of bleeding is from the cervicovaginal arteries, the distal point of the genital vascular system, just internal to the distal ureteral crossing, where a deep ligature or a misplaced clamp might easily include the ureter. Hemorrhage is not, however, so easily controlled in certain cases of undermined advanced carcinoma, where a thin cervical shell tempts the surgeon to undertake a vaginal hysterectomy, and where after his vaginal cut he finds only a crumbling, bleeding mass, which holds neither forceps nor ligature. Such a condition is not suitable for hysterectomy. The complete closure of the opening in the vaginal vault after hysterectomy conduces to the production of severe hemorrhages unless the hemostasis has been most carefully looked after. A vessel which lies upon a gauze drain, communicating with the vagina, is not at all likely to bleed seriously unless of large size, but the same vessel, turned inward and opening into the pelvic cavity, may bleed excessively.

Sepsis.—This is by far the most common cause of death after vaginal hysterectomy, but if the precautions noted in speaking of the after-treatment are carefully carried out, it will be very infrequent. There is reason to believe that it will be still more rare if the Fowler's position is insisted on in the future. While operating in a very septic field, with pus oozing in every direction, the course of the operation should be interrupted to carefully clean out the pelvis, and especial care should be employed to have the Douglas pouch cleared of all clots and septic debris before raising the pelvis to place the gauze packing. It is also to be borne in mind that septic symptoms may occur as a result of ileus, incident to mechanical obstruction, caused by an intestinal loop becoming adherent to the pelvic floor or compressed between gauze drains; therefore, if symptoms of obstruction become evident, the dressing should be removed with the patient lying in the Sims-Trendelenburg position; and then the fingers should be swept freely around the bottom of the pelvis, so as to loosen all adhesions which maintain the intestines in a faulty position. A laparotomy may be required for this complication.

PROGNOSIS.

The prognosis in cases of vaginal hemisection and ablation of the appendages in the hands of Pryor was almost uniformly favorable. Thus in his entire series of 228 cases, he had but one death, a mortality of 0.4 per cent. It is unquestionable that in ordinary hands the immediate mortality would be much higher, as a rule, although it is probable that the death-rate in this form of operation is not as high as in the abdominal operation. The operation of hysterectomy for fibroid tumor by morcellement can scarcely be compared to the usual hysteromyomectomy. The results of Noble, Kelly, Werder, Deaver, and others, in the abdominal operation for fibroid tumor will not be equaled by the operation of vaginal morcellement even in the most favorable cases.

The prognosis of vaginal hysterectomy for carcinoma by means of the cautery knife is good both as regards the immediate mortality and the ultimate result. Byrne,¹ who confined his effort principally to a high amputation or partial hysterectomy, reports 59 cases of portio carcinoma with a freedom from recurrence after five years of 47 per cent.; some of the cases were well after eighteen years. He also reports 81 cases where the disease involved the entire cervix, and of these, 22 per cent. were well after the expiration of four years. In all, Byrne operated upon 367 cases, and among these he reports that there was not a single death.

Mackenrodt,² in 1901, described a form of vaginal hysterectomy by means of the cautery knife which he called "igniextirpation." He had had 39 cases; there were 17.9 per cent. of deaths, and 42.8 per cent. of the total number of cases remained free of the disease for three and a half to six and a quarter years. There was 92.9 per cent. operability. He used a paravaginal incision and the cautery. He reports 72 per cent. of the very early cases cured by igniextirpation.

Olshausen³ reported 206 cases of vaginal hysterectomy for cancer performed in the years 1901 and 1902. The immediate mortality was 7.28 per cent. Olshausen's operation is done without the use of a cautery knife and with no very extensive dissection of the parametrium. He reports 18 per cent. of absolute cures five years after vaginal hysterectomy. His operative mortality was 6 per cent. and his percentage of operability 31.6 to 44. Unfortunately, no separation is made between cervical and corporeal carcinoma, so that his figures apply to cancer of the uterus in general and not to cervical cancer only.

The prognosis of vaginal hysterectomy by means of a paravaginal incision as recommended by Schuchardt is good. Schuchardt reports 61 operations for cervical carcinoma with 7 deaths, a primary mortality of 11.4 per cent. His percentage of operability was 56.

¹ Byrne, John: "Vaginal Hysterectomy and High Amputation or Partial Extirpation by Galvano-cautery in Cancer of the Cervix Uteri. An Inquiry into their Relative Merits," *Brooklyn Med. Jour.*, 1892, vol. vi, No. 11, p. 729.

² Mackenrodt, A.: "Die Radikaloperation des Gebärmutter-scheidenkrebses mit Ausräumung des Beckens," *Centralbl. f. Gynäk.*, 1901, Nr. 27, S. 789.

³ Olshausen, R.: "Zum Vergleich der vaginalen und abdominalen Operations-methode bei Carcinoma uteri," *Zeitschr. f. Geburtsh. u. Gynäk.*, 1903, Bd. 1, S. 1.

Staude reports 47 operations for cervical carcinoma with 9 deaths, a primary mortality of 19 per cent. His percentage of operability was 56.7.

Schauta reports 121 operations by this method, cervical and corporeal (presumably), with 15 deaths, a primary mortality of 12 per cent. His operability percentage was 43.6. None of these operators used the cautery knife.

CHAPTER XXIV.

CONSERVATIVE OPERATIONS ON THE OVARIES AND TUBES.

BY HOWARD A. KELLY, M.D.

The term conservatism is applied in gynecology to those methods of treating pelvic diseases by which structures still capable of functional activity, and therefore of use to the body, are preserved rather than sacrificed in the course of a surgical operation.

The objects of conservatism may be considered under two heads: (1) The avoidance of mutilation—that is to say, the removal of important structures; (2) the preservation of function. It is with a very right and proper feeling that the patient often insists that organs so essential as uterus, uterine tubes, and ovaries, should be kept intact even at the risk of continued suffering, and more or less invalidism. At a time not long past, when surgeons were more aggressive and less careful, while at the same time less familiar with the untoward consequences of radical operations, it became almost necessary for the patient to insist upon the preservation of her organs, in order to avoid an unnecessary mutilation. The functions conserved by conservatism are:

- (1) Maternity.
- (2) Menstruation.
- (3) Internal secretion.
- (4) Sexual instinct.

In order to maintain the function of *maternity* there must be a complete and an intact chain, or rather an open avenue from the ovarian follicle down into the uterine cavity. The ovary must be capable of maturing and extruding normal ova, the uterine tube must be capable of taking up and transmitting the ova, and the uterine mucosa must be capable of receiving and lodging them. In order to fulfil this delicate function, so essential to the perpetuity of the race, nature has supplied a capacious uterus in the center, with two ovaries and two uterine tubes leading into it. Maternity is still possible, however, if the tube and the ovary of one side are sacrificed or *hors de combat*. Maternity is also still possible if an ovary of one side is sacrificed and the tube of the opposite side is absent, leaving an ovary and a tube on opposite sides. Under such circumstances, fertilization can only take place when the ovum enters the opposite tube, and so passes down into the uterus.

Menstruation does not in any way depend upon the uterine tubes; the function is perfectly conserved in the absence of both tubes. Menstruation is also conserved in case of the removal of both tubes and one ovary, or in case only a part of a single ovary is left. Patients also often continue to menstruate when one ovary is left

behind, and a portion of the uterus, which has been amputated, say well above the cervix.

The function of *internal secretion* is generally conserved by the preservation of one or both ovaries, even in the absence of both tubes and the uterus.

It will be seen from these considerations that the most important, the fundamental pelvic organs, are the ovaries; the next most important organ is the uterus; and the organs of least importance are the uterine tubes, estimating the question of importance from the standpoint of the health and comfort of the patient. The diagram (Fig. 387) illustrates in general the methods of conservatism in the surgical treatment of these organs. For example, the most conservative form of treatment,

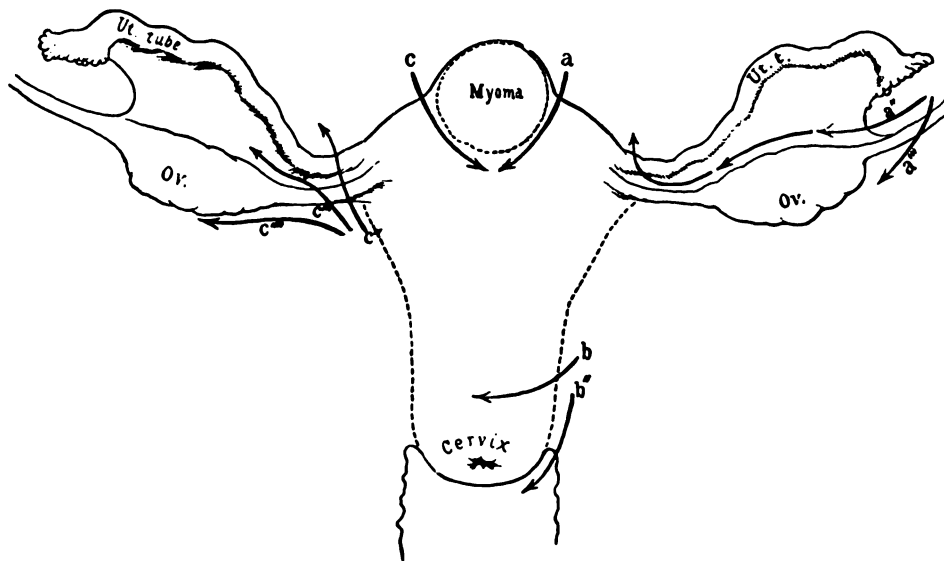


FIG. 387.—THE DIFFERENT ENUCLEATION OPERATIONS PRACTISED UPON THE UTERUS AND APPENDAGES.

The enucleation may follow the arrows starting at *a''*, removing simply the left uterine tube, or the right as the case may be. Following *a'''*, the ovary may be removed with the tube. Following the arrows at *b, b''*, the uterus is then removed with the tube, or tube and ovary, as in supravaginal amputation, or panhysterectomy. If the enucleation continues in the direction of *c'', c''',* or *c''''*, the enucleation is more or less complete accordingly. Extreme conservatism follows the lines *a-c*, as in removing a fibroid tumor without the sacrifice of any organ. Next in order comes the removal of one or both tubes; then of both tubes with uterus; lastly, one or both ovaries. The order of importance in conservatism is—ovaries, uterus, uterine tubes.

following the arrows *a-c*, is in the form of a myomectomy, or the excision of a fibroid tumor *m*, leaving all the pelvic structures intact. In an operation following the arrow *a a*, the uterine tube alone is removed, or following *a a a*, the tube with its ovary is removed. The next step in conservatism, follow the direction *b*, by which the cervix of the uterus is conserved, or *b b*, by which the entire uterus is sacrificed. Then, as the enucleation continues up the opposite broad ligament, the lines of conservatism follow the direction *c c*, leaving in the tube and ovary, or *c c c*, sacrificing the tube and leaving the ovary, or *c c c c*, enucleating the tube and the ovary. To practise conservatism we must keep within the arrows *a a a, b b, c c c c*.

Nature imposes certain normal limitations upon the conservative surgeon. In the first place, the age of the patient constitutes a limit. The organs are of most value during the period of reproductive activity, and when that period is passed, in the early forties, they gradually become of little value to the economy of the body. Under these circumstances, a surgeon will not make great efforts and assume risks in pursuing the conservative ideal, in proportion to the youth of the patient. If she is married and desires children, he will take more conservative action when he would not assume the same risks under other conditions in a patient who had this matter less at heart.

The physical condition of the patient imposes certain restrictions upon conservatism. A woman who has suffered for a long time and whose paramount desire is the recovery of health, is a less suitable subject for conservatism than one who has suffered comparatively little, and is willing to take some chances and endure some discomforts in order to conserve all her functions.

Disease also imposes its restrictions upon the efforts of the conservative surgeon. Conservatism is out of place in the case of such dangerous diseases as cancer, and it is questionable how far it ought to go in cases of pelvic inflammation. In the latter group of cases there is a notable exception to be made in favor of those treated by pelvic drainage. (See Chapter XVIII.)

While considering these natural limitations to conservatism, we must bear in mind that the patient who submits to an operation at the hands of a surgeon has a right to impose the obligation to be conservative, demanding that under no circumstances shall any organ or organs be removed. If the surgeon enters into a compact of this kind, he must consider that his hands are bound, and he is debarred from all extensive surgery, even if he encounters cancer. He must leave the disease in the abdomen as he found it, if it involves a radical operation. On the other hand, the surgeon is always entirely at liberty to refuse to operate in a case if he is thus bound; he would then best advise the patient to go elsewhere, unless she is willing to submit to his judgment in the event of the operation turning up, upon his assurance that he will act for her best interests under all circumstances. I find no cause for provocation or injured dignity in the former course.

History.—Almost as soon as extensive operations became frequent, conservatism took its birth; for certain philosophic and far-seeing men began to consider how far certain affections were to be considered dissections, and how far regeneration might take place in the event of leaving behind less inflammatory structures. The great prophet of conservatism in this country was that eminently judicial gynecologist, William M. Polk, of New York. He wrote in the "New York Medical Record" of Sept. 18, 1886, these clear and convincing words:

"It behooves us to be slow in laying operative hands upon these tubal diseases; never unless it be to cut short a peritonitis that threatens general; but in chronic cases, whenever other measures have been failed."

and found wanting, every patient should be offered that measure of relief that surely can be gotten from abdominal section.

"In the interest of conservatism, let us hope that this will not always mean extirpation of the tubes and ovaries, for who can say that the abdominal surgeon may not devise means by which those organs may be so treated as to secure health without always robbing of the possibilities of maternity?"¹

In France, the efforts of conservatism have been for the most part directed to saving the ovary from removal or mutilation, and in this connection the name of Pozzi is known throughout the world. Pozzi's chief labors have been connected with the use of the ignipuncture in the treatment of small cystic ovaries and chronic oöphoritis.² The most prominent name in Germany in the evolution of conservatism is that of A. Martin.³

It is interesting to note, in the evolution of conservatism, that what was esteemed a highly conservative treatment less than a generation ago is now adopted as a matter of course, while conservatism today is busying itself with more difficult problems. It was, for example, at one time deemed advisable, upon the removal of an ovarian cyst, to take out the opposite sound ovary in order to prevent the recurrence of a cyst on that side. The example set by Spencer Wells of leaving the second ovary, and the results of this early conservatism on his part in the birth of a large number of children to women thus saved from mutilation, speedily set at rest any question as to the advisability of conservatism under such circumstances. Even as late as 1898 we find C. Martin⁴ writing in warm defense of conservatism, that it is unnecessary in unilateral pelvic inflammatory disease to remove the ovary of the opposite side. I think I am safe in saying that while it was esteemed conservative perhaps fifteen years ago not to remove ovaries containing a few cystic follicles, today, with a better acquaintance with pathology, it is considered that these ovaries are not diseased at all, and ought never to be removed, so that the question of conservatism is not even raised.

I might state the various conservative operations in gynecology at present recognized categorically as follows:

1. Substitution of myomectomy for hysterectomy in suitable cases.
2. Saving ovaries containing large Graafian cysts.
3. Saving ovaries containing large corpus luteum cysts.
4. Saving an ovary containing hematomata or a small fibroid tumor.
5. Saving the ovary on the side of an extrauterine pregnancy, in many instances.

¹See also "Operations upon the Uterine Appendages with a View to Preserving the Functions of Ovulation and Menstruation," *Trans. Amer. Gyn. Soc.*, 1893, xviii, 175; W. L. Burrage: "Remote Results of Conservative Operations on the Ovaries and Tubes," *Amer. Jour. Obst.*, 1900, xiii, 195; and Florence N. Boyd: "Conservative Surgery of the Tubes and Ovaries," *Jour. Obst. and Gyn. of the British Empire*, 1903, iii, 241. Schröder, C.: "Die Excision von Ovarientumoren mit Erhaltung des Ovarium," *Zeitsch. f. Geb. u. Gyn.*, 1885, xi, 358.

²Pozzi, S.: "De la résection et de l'ignipuncture de l'ovaire," *Rev. de gyn.*, 1897, i, 3.

³"Ueber partielle Ovarien und Tubal Extirpationen," *Völkman's Samm. klin. Vortr.*, 1889, Nr. 343.

⁴Martin, C.: "On the Conservative Surgery of the Ovary," *Brit. Med. Jour.*, 1898, ii, 791.

6. Saving a sound ovary on one side, with a sound tube of the o
7. The suspension of a displaced ovary, instead of its removal.
8. The liberation of adherent tube and ovaries, provided the a
not too dense, and the organs have not suffered too greatly.
9. The drainage of a pelvic abscess by the vagina.
10. The drainage of the hematocele of an extrauterine pregnancy b
when it is not in an active stage of growth.

The field of conservatism has been clearly outlined in all but or class of cases—that is to say, in the inflammatory group. The gre questions always raised in conservatism are whether the patient is liabl to suffer when doubtful structures are left behind and whether the advance or disappear. These questions must be asked every time p mutilated structures are returned to the pelvis, instead of being remove

The literature on conservatism has been greatly confused by cor gether cases of conservatism of the ovary and of the uterine tube. To value, as well as its limitations, we must divide our cases into two ovarian, and the uterine tubal.

CONSERVATISM OF THE OVARY.

When the uterus is removed and menstruation ceases, the ovari undergo atrophy, but the patient, instead of passing through a storm

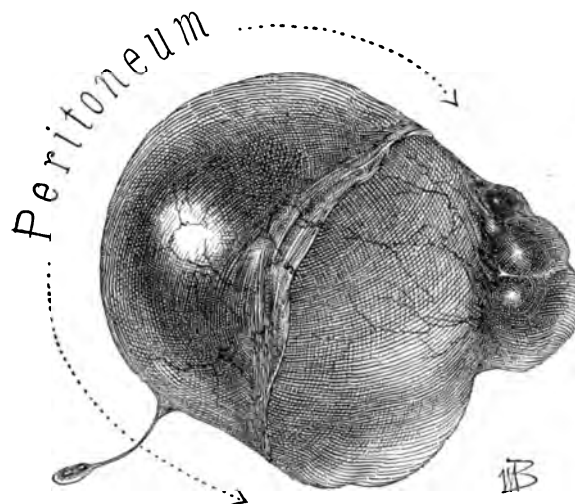


FIG. 388.—THE REMOVAL OF A PAROVARIAN CYST WITH ITS PERITONEAL COVERING, WITHOUT REMOVAL OF ITS UTERINE TUBE OR OVARY.

or less violent m
in those cases i
ovaries are remo
uterus, gradually
this change, whic
is brought about
natural, gentle
that the complet
only fully establis
average period of
years. In other
though the menop
tened and anti
supervention par
of a natural che
many distressing
often avoided.]
of the ovaries take

rapidly if but little ovarian tissue is left—in fact, the leaving of a s ovarian tissue may prove to be of no use at all (Zweifel). While of the ovary is often about three years in taking place, Krönig¹ ha

¹Krönig: Referat der Gesellsch. f. Geb. zu Leipzig, Monatschr. f. Geb. u. Gyn.,

tubes and ovaries (5 cm. long) free from atrophy, and one ovary containing a fresh corpus luteum eight years after the removal of the uterus by the vagina.

Graafian Follicle Cysts. Corpus Luteum Cysts.—The occurrence

of these cysts in no way impairs the adjacent ovarian tissue, and they should always be excised and the remainder of the ovary preserved to continue the exercise of its function. A papilloma may be excised from one side, and a Graafian follicle cyst from the opposite side, as shown in a case

figured in my "Operative Gynæcology" (first edition, vol. ii, Fig. 357, opp. p. 174).



FIG. 389.—A LARGE HYDROSALPINX WITH THE REMOVAL OF THE OVARY. In such a case, unless there is a special reason for it, the ovary should be left behind. (After H. A. Kelly.)



FIG. 390.—TUBO-OVARIAN ABSCESS REMOVED BY AMPUTATING THE UTERINE CORNU.

See piece of uterus at right hand of figure, with the conservation of uterus and opposite side. (After T. S. Cullen.)

It is a grave question whether any conservatism should be practised under such circumstances, as there is always the likelihood of the occurrence of a papilloma in the ovary which has been retained. Under all circumstances a piece of the ovarian tissue should be removed and examined microscopically. If disease is found, the abdomen can then be promptly reopened and the ovary removed.

Dermoid Cysts.—It has for some time been the practice of many surgeons to excise small dermoid cysts, or dermoid cysts growing from the periphery of the ovary, without mutilating the entire

organ. Conservatism is here advocated by Loewy and Guéniot.¹ Matthai had

¹Loewy, R., and Guéniot, P.: "Étude sur les kystes dermoïdes bilatéraux des ovaires," Rev. de Gyn., 1902, vi, 259.

three such cases followed by pregnancy, and in one of Terrier's cases a child was born two years afterward. Hermann Boldt's keen appreciation of conservatism under these circumstances is shown by his case:¹ "A prettier specimen for conservative surgery than the one presented here cannot be conceived. As can be appreciated, the dermoid formed a beautiful summit on the convex surface of the posterior edge of the otherwise normal ovary, so that its removal by simple excision and subsequent suturing of the wound was readily accomplished. It was obtained from a girl, twenty-two years old, who had menstruated regularly from her thirteenth year; always had intense dysmenorrhea and lost very little blood during the flow. She had noticed an increase in the size of the abdomen for about one year, but it did not inconvenience her until five weeks

prior to her consultation. The abdomen was distended by a large, apparently solid tumor which reached nearly to the ensiform cartilage. She was much emaciated and complained of intense pain over the entire abdomen, most marked in the flanks. Operation proved the large tumor to be a multilocular colloid cystoma with very thick contents. On the opposite side was the dermoid shown."

Tuberculosis.—Pagenstecher² has even resected both ovaries in the case of a child nine years of age with peritoneal tuberculosis; ten years later she was physically perfectly developed and menstruated.

Technic of the Surgical Conservative Treatment of the Ovary.

—In the first place, the ovary is never to be removed, for the purely technical reason that it is easier to pull up the tube and the ovary together, and so to expose the vessels and ligate them at the uterine cornu, and at the brim of the pelvis. A little more care in making a neat dissection, and a little more pains in ligating vessels and suturing the peritoneum, will enable the operator to save the ovary, even in such a case as that shown in Fig. 389, in which the large hydrosalpinx could readily have been removed, sparing the normal ovary. Fig. 390 is an example of tubo-ovarian adhesions in which conservatism would manifestly be improper. In exsecting a follicular cyst, or a hematoma, or a dermoid cyst from the ovary, care must be taken to treat the sound ovarian tissue as sparingly as possible, for if too little is left behind it may be of no use whatever. In handling these delicate

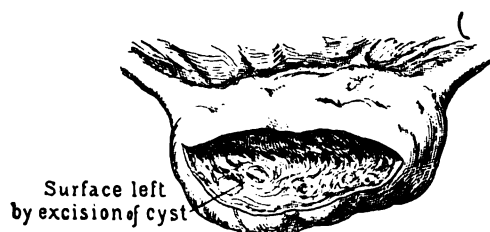


FIG. 391.



FIG. 392.

Figs. 391 and 392.—The upper figure shows the raw surfaces left by the excision of a cyst from the ovary. The lower figure shows the approximation of the wound surfaces by fine silk sutures.

¹ Boldt, H.: "Dermoid Tumor of the Ovary," Amer. Jour. Obst., 1900, xlii, 242.

² Pagenstecher, G.: "Ein Fall von Peritoneal-tuberkulose," Monatschr. f. Geb. u. Gyn., 1901, xiv, 566.

structures, and in ligating vessels and in passing sutures, care must also be exercised to maul and to interfere as little as possible with the circulation of the tissues left behind (Werth). By grasping too much tissue in the sutures which bring together the raw surfaces left by the exsection of the cyst, the atrophy of more or less ovarian tissue may result. The operator must also be careful to check all hemorrhage. This is a most important indication, as continued oozing will result in the formation of a hemothecoe, which is liable to cause infection or adhesions. The occurrence of such a post-operative hemorrhage is one of the accidents which renders a conservative operation definitely more dangerous than a radical one. It is furthermore important to lift an ovary which has been resected up from the pelvic floor and to attach it near the top of the broad ligament or at the uterine cornu. I often fix such an ovary to the round ligament.

Fine catgut or very fine silk sutures should be used and passed with fine needles. The sutures may be either interrupted or continuous. A cyst springing from the periphery of the ovary offers a simple case for an excision. When the cyst lies deeper in the substance of the ovary, the first impression conveyed is that there is little or no ovarian tissue left behind. A careful dissection shows that this is erroneous, and that the ovary has only become spread out like the petals in their relation to the calyx of a flower. Fig. 391 shows the surface left to be united

by suture after excision of the cyst, while Fig. 392 shows the union of the raw surfaces by means of interrupted sutures. An excellent union is also secured by using a fine continuous suture; when this is used, care must be taken, each time the suture is passed, to bring the surfaces into snug apposition.



FIG. 393.—THE RIGHT UTERINE TUBE LIFTED UP, SHOWING WEB-LIKE ADHESIONS KINKING IT AND BINDING IT TO THE OVARY. (After H. A. Kelly.)

THE SURGICAL CONSERVATISM OF THE UTERINE TUBE.

Conservatism of the uterine tube has to do for the most part with *inflammatory affections*, although such rare conditions as *myoma* of the tube have been mentioned in this connection. In *extrauterine pregnancy* the tube ought not to be treated

conservatively, unless the case is one which is treated by evacuation of the clots and drainage by the vagina. The ovary may be preserved, but the limit to which



FIG. 394.—THE SEPARATION OF TUBO-OVARIAN ADHESIONS, MAKING THE UTERINE TUBES FREE.
(After H. A. Kelly.)

conservatism should go with reference to the tube ought to be the amputation of



FIG. 395.—AMPUTATION OF A TUBE CLOSED AT THE PAVILION
WITH UNION OF SEROUS AND MUCOUS SURFACES FORMING
A NEW OSTIUM AT *a*.

the tube in its isthmal portion, when the pregnancy is situated in the ampulla. Cases amenable to conservatism in inflammatory affections are shown in Fig. 394, where, instead of removing the tubes, the simple incision and separation of the adhesions is sufficient to restore them to a normal activity, provided there is no lingering infection in the tubal mucosa. This constitutes the simplest form of conservatism, where the uterine tube is apparently normal throughout, and possesses a patulous, normal ostium. The next step in conservatism is the opening of the closed abdominal orifice of a hydrosalpinx (salpingostomy).¹ The great

danger here, as in all cases in which the tube contains fluid, is that subsequent to the operation infectious material, previously shut off from the abdominal cavity, will

¹Skutsch, F.: "Beitrag zur operativen Therapie der Tubenerkrankungen," Centr. f. Gyn., 1889, xiii, 565.

escape and give rise to a septic peritonitis. In all reports of long series of cases of this kind, treated conservatively, there are some deaths from this source. Conservatism is, therefore, at its least advantage and maximum danger in this group. In salpingostomy the tube is amputated either in its ampullar portion, or in the isthmus.

Frommel has shown that, unless natural conditions are imitated and the tubal mucosa is sewed to its peritoneal surface in such a way as to produce an ectropium of the tube, the opening may soon become converted into a mere slit (after twelve days in his case). Mackenrodt lays down the rule that the tubal mucosa must be turned out, and, in order to enhance the liability to pregnancy, the opening in the tube must be kept in close proximity to the ovary. Fig. 395 shows a new opening made in the tubal

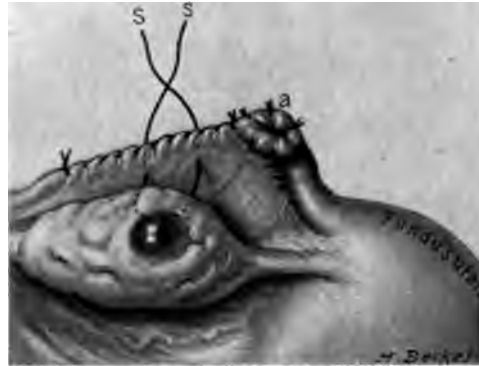


FIG. 396.—AMPUTATION OF THE AMPULLAR END OF THE TUBE WITH THE FORMATION OF A NEW OPENING IN THE ISTHMUS.

The ovary is kept near the new tubal ostium by the suture s-s.



FIG. 397.—AN ATRESIC RIGHT TUBE WITH HEMATOMA OF THE LEFT OVARY.

For the result after a conservative operation see Fig. 398. (After H. A. Kelly.)

ampulla, while Fig. 396 shows the utilization of the isthmus in this way when the remainder of the tube has been removed. When one ovary is hopelessly diseased, and the opposite tube is also diseased or destroyed by inflammation, the tube of one side and the ovary of the other, as already stated and as shown in Fig. 398, may be left in. In the case in my hands, shown in Figs. 397,

398, in which this was done, pregnancy took place soon after the operation, and the patient was delivered of a child, at term; she had, however, an extrauterine pregnancy at her next conception.

The Results of Conservatism.—Death may take place from infection from a tube. Hemorrhage may take place into the peritoneum and give rise to peritonitis. Adhesions may, and often do form over again, rendering the operation nugatory. In a number of instances, several in the writer's own practice, it has been noted that in extreme cases of conservatism in pelvic inflammatory disease, where portions of an ovary have been freed and kept, the ovaries have been liable to undergo subsequent cystic degeneration. Such a case was reported by H. C. Coe.¹ The patient in the course of two operations had her left tube and ovary and the right



FIG. 398.—THE RIGHT TUBE AND LEFT OVARY REMOVED

The uterus brought forward by vesico-fixation. In this case pregnancy followed soon, and a child was born at term. (After H. A. Kelly.)

tube removed, while the left ovary remained *in situ*; a cystic tumor the size of a small orange subsequently developed in this ovary. A similar case is reported by Fischer.² Similar cases are reported occurring in bits of ovarian tissue *unintentionally left behind*. In all these cases great difficulties were encountered at the first operation in liberating the lateral structures; in two cases out of four they could only be removed in pieces. Hugo Ehrenfest, of St. Louis, discusses this subject briefly.³

Among frequent post-operative sequelæ, noted in cases treated conservatively, are the continuance of the pain of dysmenorrhea, and of metrorrhagias and menorrhagias.

¹Coe, H. C.: "A Cyst Developing from an Ovary after Conservative Operation," Amer. Jour. Obst., 1900, xli, 389.

²Fischer, I.: "Zur Frage der Erhaltung von Ovarialresten," Centralbl. f. Gynäk., 1900, xxiv, 817.

³Ehrenfest, H.: "Cystenbildung in Ovarialresten," Centralbl. f. Gynäk., 1901, xxv, 205.

CHAPTER XXV.

OPERATIONS BEFORE PUBERTY.

BY H. A. KELLY, M.D., AND E. HURDON, M.D.

It is now generally recognized that children, even young infants, are subject to almost all the affections of the reproductive organs that are found in adults. In some instances, moreover, conditions first observed after puberty are due to pre-existing affections not discovered until the organs are called into active use. Malformations of the reproductive organs cover the whole range of these affections in the adult, but are rarely discovered in childhood. In all large hospitals for children a considerable proportion of the little patients are found to be suffering from gonorrheal infections of the vulva and vagina, and the most severe internal lesions, such as salpingitis or localized and general peritonitis, are relatively frequent (Sänger). Tubercular disease of the genital organs and malignant tumors are observed with increasing frequency every year.

Examination.—The examination consists of an investigation into the general condition of the child and the systematic examination of the abdomen by means of inspection, palpation, percussion, and auscultation. These procedures are carried out, in general, as in the case of adult patients, with the exception of the vaginal and bimanual examinations. A vaginal examination is never permissible nor necessary in young children unless there is evidence of injury or disease of the external organs and the introitus vaginæ, or a vaginal discharge is found. In such cases a digital examination should never be attempted, but the vagina and cervix should be inspected through a small cylindrical speculum, which is easily introduced by means of an obturator without injury to the part, and, if cocain has been applied, without pain. For this inspection the child should be placed in the knee-chest posture (Fig. 400). Slight operations upon the vagina and cervix and local applications may be made if a small speculum is used, without injuring the hymen or vulva.

Palpation.—The importance of a combined rectal and bimanual exploration in all obscure ailments of children was urged in 1896 by G. Carpenter,¹ but is still too frequently neglected. In the case of very young children an anesthetic is usually necessary, but with older children it is often possible to make a satisfactory examination without it. A bimanual rectal and abdominal exploration in children is not only useful in detecting pelvic disease, but, on account of the relatively great length of the examining finger as compared with the small size and close anatomic relation of the abdominal organs, it is possible to explore almost the entire abdomen in

¹ Carpenter: *Pediatrics*, 1896, vol. i, No. 11, p. 481.

young children. The advantage, of course, grows less as the age increases, but in older children the iliac, hypogastric, and umbilical regions are usually readily palpated and diseases easily detected about the appendix, the mesenteric glands, etc. In making the examination through the bowel the utmost delicacy of touch must be employed, as the structures are easily injured, and not infrequently, even in adults, the rectum has been torn through into the peritoneal cavity.

Operations upon young children are frequently performed with success and the tender age of the patient should not be regarded when considering the advisability of operating, unless it is urged as a reason against any delay in giving the child the relief afforded by the removal of the disease. All serious operations upon children under five years of age are attended by a high mortality, but the large percentage of malignant tumors in young children, the rapid course of benign as well as malignant growths, and the child's naturally feeble resistance against disease, combine to make delay especially dangerous in these cases. Older children stand operative treatment remarkably well and the percentage of cures is equal to that obtained in adult cases. It is particularly necessary in operations upon children that everything should be in perfect readiness so that there shall be no undue delay; that the anesthetic shall be limited to the shortest possible time; and that the child's body, especially the thorax, shall be kept warm throughout the whole operation.



FIG. 399.—METHOD OF REMOVING A CERVICAL POLYP IN A YOUNG GIRL.

DISEASES OF THE VULVA.

In considering the disease of the external genitals or vulva, the structures which have to be taken up are the labia majora, with the vulvar glands, the labia minora, the clitoris, and the vestibule. As in children the diseases which start in any one of these structures usually extend to some or all of the remainder, it is more convenient to regard them as parts of one organ when considering their pathologic conditions.

The affections of the vulva include (1) malformations, (2) inflammatory diseases, and (3) neoplasms.

Malformations of the vulva may be congenital or acquired. A general consideration of the congenital anomalies will be found in the chapter on the pathology

of gynecologic disease, and in this place only those abnormalities will be considered which are apparent during childhood and are of practical interest to the gynecologist.

Atresia vulvæ ("Conglutinatio vulvæ").—Adherence of the labia majora or minora, causing partial or complete atresia of the introitus vaginæ, is comparatively frequent and may be congenital or acquired. Edwards noted the presence of this condition in 9 infants out of a series of 250 births. Other observers believe that the

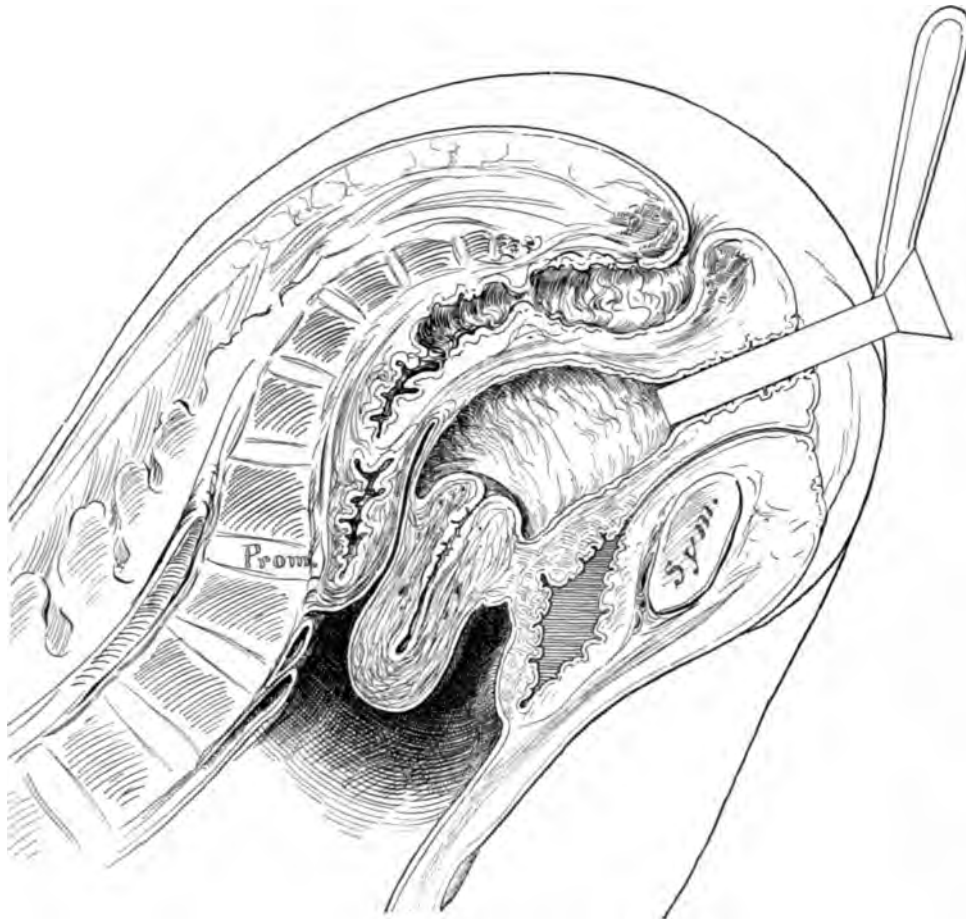


FIG. 400.—SMALL CYLINDRICAL SPECULUM USED IN EXAMINING THE VAGINA AND CERVIX IN A CHILD.

congenital cases are infrequent, but that a slight agglutination occurs a day or two after birth. The condition is probably very rarely a true developmental anomaly, although it is sometimes due to intrauterine adhesions of the mucous surfaces. In a case described by Kelly ("Operative Gynecology") the condition was apparently due to developmental causes. The labia majora were united by a dark thin membrane with fine lines upon it radiating upward and outward from a well-defined central vertical raphe. The genito-urinary opening was only 3 mm. in diameter. Two

other cases with a similarly developed membrane were also observed by this author, who regards the condition as one of abnormally long fourchette produced by faulty development. In the majority of cases the adhesions are very slight and are described by Bokai as epithelial union of the labia. The disappearance of the horny layers of the epithelium is followed by cohesion of the opposite surface, and the union then not infrequently becomes organized. Similar adhesions of the vaginal mucosa are described by Zweifel.¹

Many cases of vulvar atresia are the result of a neglected infantile vulvovaginitis, in the majority of cases due to gonorrheal infection. In a case of vulvar atresia in a child four years old, seen by Cullen (Fig. 401), the slight adhesion was apparently the result of an old inflammation. The chief symptom was increasing

difficulty in micturition, of about a year's duration. The adhesion was easily separated by blunt dissection and no bleeding occurred. Complete atresia in a few instances has also resulted from infection with the Klebs-Loeffer bacillus.

Treatment.—Where the two sides are joined by a dense membrane it is necessary to cut it down to its base, and occasionally a few sutures are required to control bleeding. In many cases the adhesion can be separated by means of a blunt dissector, reunion then being prevented by separating the surfaces with a small plug of sterilized gauze smeared with vaselin.

As a rule, a general anesthetic is advisable, but with slight adhesions cocain may sometimes be used. If the condition is not attended to early, the adhesions are liable to become denser and may be a source of danger when menstruation is established.

Adhesions of the prepuce to the glans of the clitoris is very common, and if there is an accumulation of smegma behind the adhesions an



FIG. 401.—ATRESIA OF THE VULVA.

a, Upper portion of the labia majora. b, Beginning of the labia minora. c, Genito-urinary orifice. d, Line of adhesion of vulva. (Case of T. S. Cullen.)

irritable condition develops which may be the cause of masturbation and of severe nervous disturbances.

Adhesions of the prepuce to the glans of the clitoris should be carefully freed and all secretion removed.

Hypertrophy of the labia and clitoris is occasionally seen in the new-born as well as in older children, but is rare in temperate climates. S. H. Grandin, who relates two instances of hypertrophied clitoris in Hindoo infants of twelve months, regards the affection as being probably the result of masturbation induced by pre-

¹ Billroth and Luecke: "Handb. der Frauenk.," S. 179.

putial adhesions, and urges the importance of a careful examination for this condition in female as well as male infants.

Vulvitis.—Inflammatory diseases are the most serious gynecologic affections occurring in children, both on account of their comparative frequency and because of the grave complications which may develop. These affections are particularly frequent in the free clinics, as it is among the neglected children that the disease is most prevalent. The children of the well-to-do, however, are by no means exempt. Inflammatory diseases of the vulva may be divided into three groups: (1) Simple inflammation; (2) gonorrheal infection; (3) other specific infections, as tuberculosis and diphtheria.

Simple vulvitis may be merely a local manifestation of some constitutional dyscrasia, such as diabetes; or it may be a strictly local affection, the result of uncleanness. It varies in severity from a slight erythema to an extensive furunculosis, diffuse phlegmon, or gangrene of the parts. The disease is commonly met with in poorly nourished, unclean children. Local irritants, such as contamination with urine or feces, the oxyuris, or traumatism, may produce an exceedingly severe inflammation, characterized by swelling and reddening, excoriations, and sometimes deep ulceration. The disease does not spread to the vagina. Masturbation, according to Veit ("Handbuch"), causes a characteristic chronic inflammation of the vulva and vagina which is especially marked by elongation of the nymphæ and clitoris, redness of the vulvovaginal mucosa, and unusual prominence of the sebaceous glands of the nymphæ.

Aphthous vulvitis is a rare affection due to the activities of an organism resembling the *oïdium albicans*, and is characterized by the formation of white patches on the reddened mucous surface.

Erysipelas of the vulva is a somewhat frequent disease in infants suffering from streptococcus infection of the navel, and may also occur as a primary infection, especially among the filthy children in overcrowded districts.

The treatment consists in the hygienic care of the affected parts, accompanied by alkaline washes to allay the irritation, and the exhibition of tonics and suitable diet where constitutional disorders are present.

Gonorrheal Vulvitis.—Most cases of vulvar inflammation are due to infection with the gonococcus. In the Johns Hopkins Hospital Dispensary the gonococcus is found in the discharge in 63 per cent. of the cases of vulvitis in children. Dukelski¹ found that about 80 per cent. of his cases had a gonorrheal origin, and Welt-Kakels² found that the majority of the cases observed at the Mt. Sinai Hospital Dispensary were due to the gonococcus. The infection may have either a direct venereal origin or may be propagated by means of infected towels, or bed-linen or other articles, or the infant may be infected during birth. It is not unusual to find two or more children in one family suffering from the disease, while in children's hospitals small epi-

¹ Dukelski: Jahrb. f. Kinderheilk., 1904, lix, S. 397.

² Sara Welt-Kakels: N. Y. Med. Jour., 1904, vol. lxxx, p. 689.

demics are common. Cotton¹ reported a recent epidemic of gonorrheal vulvovaginitis in a Chicago hospital affecting twenty children. Kimball² relates that among 600 admissions to the public ward of the Babies' Hospital 70 cases of gonorrheal vulvovaginitis occurred, a large proportion of which developed in the hospital. Probably about 10 per cent. entered with the disease and became the source of a small epidemic. Only complete isolation can prevent the spread of the disease, and it is now the custom in some hospitals to examine a smear from the vaginal secretion of every girl admitted and to keep her isolated for several days before allowing her to enter the ward. Children who have contracted the disease should not be permitted to attend school until all danger of spreading the infection is past.

Pathogenesis and Symptoms.—The symptoms of gonorrheal vulvitis are identical with those observed in adults. The onset may be abrupt, but is usually insidious. A more or less copious greenish-yellow discharge is first noticed and the vulva is swollen and inflamed. The child suffers from smarting and burning of the external parts. *Ardor urinæ* is a pronounced symptom, and frequent, slightly painful micturition persists after the acute stage is passed. The inguinal glands are usually enlarged. Bartholin's glands may be enlarged and sometimes are converted into abscesses. The urethra is usually affected in every case, according to Rudsky, and a caruncle sometimes develops, producing much pain. Voluminous vulvar vegetations are common in little girls suffering from chronic gonorrheal infection. Ischiorectal abscesses are uncommon, but I have seen one case in a child of four years. K. Flügel found rectal infection in 20 per cent. of the cases of gonorrheal vulvitis in children. The chief symptoms of this complication are a burning sensation and a frequent desire to empty the bowels. A mucous discharge may be noticed, but as a rule is discovered only through the speculum. Ulceration of the rectal mucosa is rare. Extension to the vagina is much more frequent in children than in adults, and the infection of the pelvic organs and peritoneum is by no means infrequent. Kimball reported 8 cases (7 girls) of gonorrheal pyemia with multiple arthritis in children under three months. As the acute symptoms subside the disease pursues a chronic course and may terminate in a few weeks or may continue for months, and the child may become extremely debilitated.

The treatment of gonorrheal vulvitis in children is exceedingly troublesome to cure and relapses are frequent. According to Kimball, the affection was much more amenable to treatment in infants under one year, and the average duration in these cases was about ten days, while in older children a longer time was required. In Cotton's cases, in spite of heroic treatment, the average duration of the disease was 116 days. The best results are obtained by means of frequent, thorough irrigations. Solutions of bichlorid of mercury (1 : 10,000) or potassium permanganate (1 : 2000), followed by applications of AgNO₃, 5 per cent., have proved most useful in these cases. Kimball found a 2 to 5 per cent. solution of protargol the most useful. The

¹ Cotton: Arch. f. Pediatrics, New York, 1905, xxii, 100.

² Kimball: Med. Record, 1903, vol. lxiv. No. 20, p. 761.

rectal infection is amenable to treatment with suppositories of argentic nitrate or ichthyol (Flügel).

Diphtheritic vulvitis is a not infrequent complication of pharyngeal diphtheria in children, and, as in Silberstein's case,¹ the vulvar infection may give rise to urgent symptoms before the pharyngeal condition is suspected. The affection is characterized by swelling, dark red discoloration, ulceration, and sometimes gangrene of the vulva, attended with the usual constitutional symptoms of diphtheria. In a case of diphtheritic vulvitis mentioned by Edwards, a complete cast of the vagina was thrown off, with a resulting vaginal atresia which later on necessitated operative relief.

Treatment.—The disease readily responds to the administration of antitoxin, but in the healing of extensive necrosis of the vulva care must be taken to prevent a subsequent atresia.

Tuberculosis of the vulva is a relatively frequent affection in children as compared with its rare occurrence in adults. The disease may be primary or secondary.

Primary tuberculosis of the vulva is exceedingly rare, but there are a few cases recorded which clearly demonstrate its occurrence in young children. In Schenk's² case the child had played for a long time with two tubercular children. In one of Demme's³ cases the eleven-months-old child had apparently contracted a vulvo-vaginal infection from a tubercular mother, and in another case of vulvovaginal tuberculosis in an infant of seven months, the father was tubercular.

Secondary tuberculosis of the vulva may be due (1) to propagation of the infection by continuity of structure, as when the pelvic organs or the bones of the pelvis or hip are affected; (2) the disease may be due to metastatic transportation by way of the blood or lymph-vessels; or (3) it may be conveyed by contaminated fingers or linen in cases of pulmonary tuberculosis, or from the stools in tuberculosis of the alimentary canal.

Vulvar tuberculosis usually appears in the form of the characteristic flat ulcers having irregular, infiltrated margin and a grayish or greenish-yellow base studded with miliary nodules. More rarely the disease develops in the form of a diffuse swelling and induration of the parts. The treatment consists in the excision of the affected area and the general hygienic care of the child.

Tumors.—The only tumors of the vulva in childhood described are the not infrequent angiomas and a single case of lipoma of the vulva in a five-months child, observed by Quénu.⁴ A small cyst of the vulva is shown in Fig. 402. Guyot observed a cavernous angioma of the vulva in a child of six years. The tumor was bilobed and of considerable size. Edwards, Herring, and Sängner have directed attention to the circumscribed and extensive diffuse angiomas of the vulva in new-born infants. The angiomatous swelling often involves the neighboring

¹ Silberstein, L.: Deutsch. med. Woch., Bd. xxvi, 1900, S. 566.

² Schenk: Beit. z. klin. Chir., 1896, Bd. xvii, S. 526.

³ Demme: Wiener med. Blätter, 1887, Nr. 50, S. 1576.

⁴ Quénu: Bulletin Soc. de Chir., 1890, xvi, No. 1, p. 54.

parts, extending to the buttocks and down the thighs. Sloughing of the center of extensive cases may occur (Edwards).

The *treatment* which has proved most successful is electrolysis.

DISEASES OF THE VAGINA AND HYMEN.

Malformations.—Anomalies of the hymen, including absence, double hymen, double or multiple orifices, are present at birth, but are usually only discovered accidentally. Imperforate hymen and vaginal atresia are seldom detected before puberty. In some instances a protrusion of the septum during violent crying has directed the attention to the condition, while in other instances a collection of



FIG 402.—HYMEN WITH TWO UNEQUAL ORIFICES
SMALL VULVAR CYST IN A CHILD.

mucus behind the septum has produced a fluctuating tumor between the labia. Granwell¹ reports a case where, in an infant one month old, a tumor mass filled the pelvis and lower abdomen almost to the umbilicus. The vulva and perineum were reddened and edematous. Retention of urine was first suspected, but after an unsuccessful attempt to pass a catheter, the vaginal obstruction was discovered. Incision of the membrane allowed the escape of a small amount of pus followed by about 400 c.c. of lemon-colored fluid. Slight epithelial adhesions between the mucous folds immediately behind the hymen are not uncommon in children and may be mistaken for imperforate hymen. Spontaneous rupture usually takes place, but it may be necessary to separate the union with a probe.

Imperforate A us.—Developmental errors depending upon the persistence of the cloaca result in the persistence of abnormal communication between the vagina, bladder, and rectum. The most extreme conditions are found only in non-viable fetuses, but in the living child the external anus is sometimes absent and the rectum opens into the vagina or vulva. Ihl² describes a case in which the urethra opened into the vagina and the rectum ended in the upper vaginal wall. A radical operation has excellent results in suitable cases if undertaken early. In less favorable cases, as when the anal opening is too high or the deficiency of structure too great, the condition may be improved by providing the abnormal opening with a sphincter.

Retentio Mensium.—Atresia of the vagina at any point is followed by an accu-

¹Granwell: Rev. de Gyn., 1905, No. 9, p. 635.

²Ihl: Zeit. f. Geb. u. Gyn., Bd. lv, S. 373.

mulation of the menstrual flow above the obstructed area. If only the hymen, the anterior or the middle portion of the vagina is obstructed, the superior portion becomes distended, producing a hematocolpos. The vagina becomes greatly distended before the uterus is affected (Fig. 403), but with the increasing distention, partly through pressure and partly by means of the traction exerted by the stretching of the vaginal tissue, the cervix becomes thinned out and finally is practically obliterated, and the uterus then becomes distended with the menstrual secretion. If the menstrual retention continues beyond a certain time the tubes may also become dilated, forming a double hematosalpinx. The percentage of cases in which the tubes are found distended varies considerably in different collections of cases.



FIG. 403.—HEMATOCOLPOS DUE TO ATRESIA OF THE LOWER PORTION OF THE VAGINA.
a, Distended upper portion of the vagina (Cullen).

Puech found only 16 out of 300 cases, while Janicot¹ found 50 per cent. in a series of 68 cases.

The mechanism of the development of the tubal hematomata is not definitely understood. The theory formerly accepted, that all cases were due to reflux from the uterus, does not explain the cases in which the proximal end of the tube is occluded. On the other hand, the view that the hematosalpinx is produced by a transudation from the mucous lining of the tube itself is open to the objection that menstruation does not normally occur in the tube, although its occurrence in pathologic conditions has been observed. Sanger accepts Fabricius' view that a large

¹ Janicot: Thèse, Bordeaux, 1903.

proportion of cases of tubal hemorrhage in cases of atresia may be explained in the same way as in cases of uterine myomata—namely, a passive congestion of the tube results from the contraction of the uterine walls.

Prognosis.—If the atresia is not relieved early, the prognosis is exceedingly grave. In rare instances the mass remains indefinitely without giving rise to any pronounced symptoms, as in a case described by James Murphy,¹ where the first symptoms of hematometra became manifest at forty-two years of age. More often serious complications develop within a year or two of the beginning of the retention. The two chief dangers are rupture and inflammation. Spontaneous rupture is the usual sequel of the distention and may occur either externally or internally. In external rupture, as a rule, the vaginal wall is the part to give way, but cases

have been recorded in which rupture occurred through the base of the labium majus; and Bolling (Janicot) described a case where the hematoma opened in the gluteal region. External rupture is sometimes followed by complete recovery, but in many cases the pocket becomes infected and the patient succumbs to septicemia.

Internal rupture is more frequent than rupture externally. The perforation is usually in the vaginal wall, but in a few instances it has been observed in the uterine wall. The hematoma frequently opens into the rectum, less commonly into the bladder.

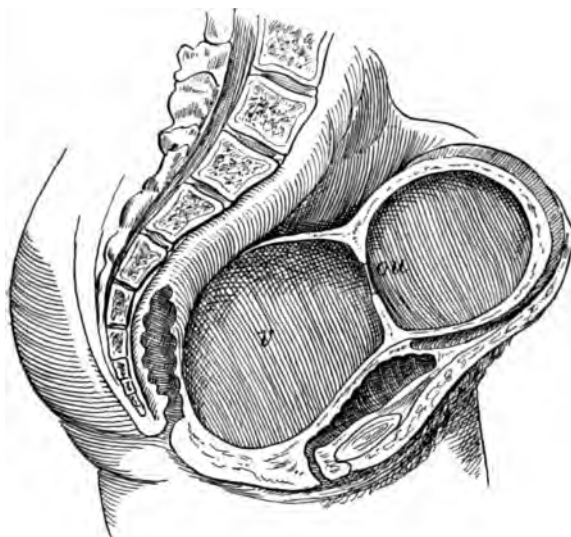


FIG. 404.—ATRESIA OF THE VAGINAL ORIFICE; HEMATOCOLPOS AND HEMATOMETRA.

v, Vagina; ou, internal os (T. S. Cullen).

In one case the stomach was perforated. Recovery may follow rupture into the bowel, but it is not perfect, as there persists a rectovaginal, or rectouterine fistula, or, the fistula becoming closed off, there is a recurrence of the menstrual retention. Unfortunately, one of the most frequent as well as one of the gravest terminations of prolonged menstrual retention is rupture of the tubes into the peritoneal cavity. If only a small amount of blood escapes at a time, it may become walled off, forming a pelvic hematocele, but very often a more abundant hemorrhage occurs and causes immediate death or a rapidly fatal generalized peritonitis. This accident should be very rare, as rupture of the hematoma in cases of atresia occurs only after prolonged retention, usually not until one or two years after the appearance of the first symptoms.

¹ Murphy, James: Brit. Med. Journal, 1895, vol. i, p. 65.

Clinical History.—The symptoms arising from vaginal atresia do not manifest themselves until puberty, at which time the child presents the usual physical and psychic developmental changes incident to this period, and the menstrual molimina appear with more or less severity, but unaccompanied by the usual external signs. The chief symptoms are amenorrhea, pain, and tumor. The onset of the symptoms may be abrupt, with severe cramp-like pains in the pelvis and abdomen, or may develop insidiously, with a feeling of general malaise, associated with more or less discomfort in the pelvis. In all the cases of retentio mensium which have come under my observation, the earliest evidence of the trouble consisted of sudden, severe, cramp-like pains, which came on without warning while the patient was in good health. The pain may be persistent for days or weeks, or may recur daily, lasting only a few hours. The initial attack gradually subsides and the patient may be free from pain for two or three months, when a similar attack occurs. After the second or third attack there is a less complete cessation of pain and the patient suffers from a constant feeling of weight and pressure in the pelvis. With each succeeding period the pain becomes more intense, often resembling labor pains, and is finally associated with pronounced nervous manifestations, such as hysteria, syncope, epileptiform convulsions, and nervous chills. Symptoms of localized peritonitis sometimes develop in a later stage, and may be due to a slight escape of blood into the peritoneal cavity.

Treatment.—A spontaneous cure of the disease is so uncertain that early surgical interference is indicated in all cases, the appropriate operation depending upon the position of the atresia and the condition of the pelvic organs. An exact diagnosis of the condition present is of the first importance.

Atresia of the hymen or of the anterior part of the vagina usually results in a simple hematocolpos without involvement of the higher pelvic organs. An incision through the distended membrane followed by emptying of the sac is usually all that is necessary, and may be done without anesthesia. If the denuded area is somewhat extensive the mucous lining of the vestibule may be loosened and drawn up to meet the mucous membrane of the vagina. In cases where the atresia of the anterior portion of the vagina extends for a distance of 3 or 4 cm., careful dissection is necessary in separating the rectum from the bladder wall in order to avoid injuring either of these organs. The extensive area of denudation may be covered over by drawing down the vaginal mucosa (usually readily separated) and uniting it to the mucosa of the outlet.

If the uterine cervix is patulous the cavity should be emptied and a bimanual examination then made to determine the condition of the tubes. If they are normal, the operation is finished; but if they are distended an abdominal section with removal of the tubes ultimately may be required. The blood from the tubes may discharge through the uterus and a satisfactory result may follow. In such cases the abdominal ostia are generally occluded and sterility usually follows. If the tubes do not empty themselves, or if infection results, the removal of the tubes may become necessary.

In atresia of the upper vagina and cervix every effort should be made to preserve the organs and to restore their function, and a radical operation should be performed only when it is practically impossible to construct a permanent communication between the uterine cavity and the vagina. The first question to be considered in regard to the operation is whether it should be performed by the vaginal route, by the abdominal route, or by a combination of both. In atresia of the upper portion of the vagina, Säger advocates the abdominal route, claiming that it is easier by this method to divide the septum between the bladder and rectum without tearing either structure. Others prefer the vaginal route in the beginning, but in some cases combine the abdominal method. In all cases where the tubes are distended the abdominal route is advisable.

The vaginal operation consists in the division of the septum and the covering of the denuded area with mucous membrane. In congenital atresia this is more readily performed than in acquired conditions, because in the latter, on account of the scar tissue present, the mucous membrane is less readily separated from the underlying tissue of the vaginal wall. When it is impossible to cover the denuded area with the vaginal mucosa, grafting with mucous membrane from the vulva may give satisfactory results. An excellent flap may be formed from each labium minus.

In atresia of the cervix the construction of a permanent canal through the dense tissue of the long narrow cervix is often impossible. An incision may be made in the wall of the uterus immediately above the cervix and extended down through the cervix, after which the vaginal mucosa is drawn up and attached to the endometrium. If the septum is so broad that the vaginal mucosa cannot be drawn up into the canal, it has been suggested by Döderlein, Krönig, and others, that the fundus be drawn down, and a channel for the menstrual flow made by an opening through the uterine walls directly into the cavity. The canal may be kept open by drawing down the endometrium to meet the vaginal mucous membrane. This operation was successfully performed by Hofmeier, who found a year later that the opening would scarcely admit an ordinary sound, but menstruation occurred regularly. On account of the impossibility of delivery in the event of pregnancy occurring in such a case, the advisability is considered of removing the tubes by way of the abdomen at the time of the operation.

In atresia of the upper part of the vagina and of the cervix the vaginal method of operation is especially difficult, as the bladder and rectal walls are in close apposition. In such cases the abdominal route is adopted by most operators, notably Wertheim, Zweifel, and Halban. When the abdominal cavity is opened the relation of the bladder to the fundus is easily recognized, and there is no difficulty in separating the bladder down to the vagina. The cervical wall may then be fixed to the rudiment of the vagina. If the septum is so broad that a permanent canal through the cervix cannot be constructed, the fundus may be drawn down and an opening made directly into the cavity, as described above. It is questionable if, considering the difficulties in the operation and the risks of pregnancy, a primary radical operation would not be advisable.

In vaginal or cervical atresia, accompanied by hematosalpinx, abdominal section is always indicated. A conservative operation upon the tubes may be possible in exceptional cases, but as a rule their removal is the only safe procedure.

Hematometra in a rudimentary uterine horn is exceedingly difficult to diagnose, as menstruation occurs normally in the developed portion of the uterus. The unequal enlargement of one horn of the uterus and the development of a softish, semi-fluctuant tumor distinguishes the condition. Hofmeier, in one case of hematometra in a rudimentary horn, opened the sac through a vaginal incision and sutured the uterine to the vaginal mucosa. If the sac is too high up to make a communication with the vagina, laparotomy is indicated. The distended rudimentary horn may then be resected, as in the case of a myomectomy, and the wound into the uterine wall closed with deep and superficial sutures.

Vaginitis.—With few exceptions vaginitis in children is due to gonorrheal infection. A simple vaginitis in children, in rare instances, is caused by the irritation of foreign bodies in the vagina, and occasionally intestinal parasites lodged in the vagina have excited a mild inflammation.

Gonorrheal vaginitis is relatively much more frequent in children than in adults and is found in the majority of cases of vulvar infection. The susceptibility to vaginal infection in children is probably due to the greater delicacy of the mucous lining of the vagina. The vaginal mucosa is edematous, granular, intensely hyperemic, and bathed in the purulent discharge.

Diphtheritic vaginitis frequently accompanies the infection of the vulva, and may result in the sloughing of the whole mucous membrane.

Tuberculosis of the vagina is relatively more frequent in children than in adults. E. Menne,¹ analyzing 42 cases of virginal genital tuberculosis, of which 29 were in children under fifteen years, found the vagina affected in 19.2 per cent. as compared with 9.6 per cent. of the cases in general. Mlle. Bonnin regards the presence of a slight abrasion or injury of the mucosa as essential for the localization of the infection. The disease may appear in the form of irregular tubercular ulcers or as miliary tubercles.

Treatment.—Localized tubercular areas should be excised. Miliary tuberculosis can only be treated by general and local hygiene.

Tumors.—Congenital cysts of the hymen are comparatively frequent and are retention cysts which develop, as a rule, on the external surface, but may also be found on the inner surface. They may be single or multiple. The majority are very small, varying from 2 to 8 or 10 mm. in size. In a case described by O. Müller² a congenital cyst of the hymen caused retention of urine. Ricci's cyst (cited by Gellhorn) was the size of a cherry.

Cysts of the vagina are also mostly retention cysts and may be present at birth or may develop soon after. The pathology of these cysts is described in Chapter III.

Solid Tumors.—Of solid tumors of the hymen, Gellhorn found two reports of

¹ Menne, E.: Dissertation, Griefswald, 1901.

² Müller, O.: Archiv für Gynäk., Berlin, 1890, xlv, 263.

polypus and one of angioma. Solid tumors of the vagina include fibroma, myoma, sarcoma, and carcinoma. Benign tumors are exceedingly rare and the few cases reported lack careful histologic description.

Sarcoma of the vagina is much more frequent in children than in adults, and with few exceptions it belongs to the characteristic form of sarcoma which develops in the vagina only during childhood and is usually described as grape-like sarcoma, myxosarcoma, or sarcoma botryoides. The tumor usually appears during the first years of life, and in a few cases was observed at birth, or a few days after. Out of 26 cases collected by Starfinger,¹ 24 were in children under five years, and 10 under one year. The growth appears at first as a small, red, broad-based or pedunculate polypus which presents at the vulvar opening and, as a rule, is attached to the anterior vaginal wall. The primary tumor may remain quiescent for months or years and from its macroscopic appearance cannot be distinguished from a simple polyp. Sooner or later, however, it begins to proliferate, and disseminates in the form of multiple pedunculate vesicular or hemorrhagic polypi, which fill the vagina, finally invade contiguous structures, and may produce widespread metastases (Fig. 58, Chapter III).

Clinical History.—In some cases the child complains first of pain in the vulva, in others the first thing noticed is the presence of the tumor between the labia. Painful micturition and later complete retention are prominent symptoms. There is often great pain on defecation. The nutrition of the child may not appear to be impaired until very late, and the fatal issue may be directly due to urinary obstruction; in other instances there is evidence of general sepsis resulting from extensive necrosis of the tumor, or there may be a gradual loss of weight and strength due to the invasion of the growth. The prognosis is grave. Simple excision of the primary tumor is always followed by recurrence, which may take place very rapidly or may not appear for years. D'Arcy Powers excised a congenital tumor from a six-weeks infant, and recurrence did not take place until three years later. In Schuchardt's case a second excision of the tumor with a wide area of surrounding healthy tissue resulted in complete cure, the patient being well ten years later. Israel (Hollander's case) successfully extirpated the entire genital tract of a child of two years. The following typical case of grape-like sarcoma of the vagina in a child was observed in Kelly's clinic at the Johns Hopkins Hospital:

E. B., two and a half years old, admitted with the diagnosis of tumor of the vagina. The tumor was painful, grew rapidly, and produced severe urinary disturbances, terminating in complete retention. The child's nutrition was but slightly impaired, and death was directly due to the urinary obstruction. Examination revealed a papillary, pinkish mass, of somewhat firm consistency, which protruded from between the vulva and had a broad-based attachment to the lower vaginal wall. Above this mass the vagina was completely distended by a cluster of grape-like polypi. A few of these polypi were hemorrhagic, but the majority were pale and translucent, resembling the vesicles of a hydatidiform mole. The vesicovaginal septum was

¹ Starfinger: Dissertation, Berlin, 1900.

penetrated and a large hemorrhagic tumor of firm consistency protruded into the bladder. At autopsy it was found that the disease had invaded the parametrium, surrounded both ureters, and developed upon the abdominal peritoneum. Metastases were found in the lungs. Microscopically the characteristic structure of the racemose vaginal sarcomata of infancy was typically represented in the tumor. Striated muscle fibers were found, not only in the primary tumor but in the secondary growths, and in the lung metastases.

Carcinoma of the vagina in childhood is almost unknown. Smith (Edwards) observed a cancer of the rectovaginal septum in a child of fourteen months. Guersant saw a large, circumscribed, carcinomatous tumor growing from the introitus of a child of three and a half years, and Johannesky found a cancerous nodule situated in the vaginal vault in a museum preparation from a girl nine years old.

DISEASES OF THE UTERUS.

Malformations of the uterus are never discovered during childhood, except in the rare instances of hypertrophy of the cervix associated with descensus.

Prolapsus of the uterus is an unusual condition in childhood, but cases have been observed in infants a few days old, and in older children complete prolapsus has followed prolonged exertion or severe strain. The majority of the infantile cases were associated with spina bifida and other congenital defects and the infant did not live more than a few weeks or months. Redwansky, however, observed a case in an infant with no other defect.

Treatment.—In several instances of acute prolapsus in children and young girls a permanent cure has been effected by a simple reduction of the displacement, followed by prolonged rest in bed, sometimes with the addition of cold baths and cold douches.¹ When this treatment is not successful operative interference is indicated, the best results being obtained by means of abdominal suspension of the uterus, if necessary combined with amputation of the hypertrophied cervix and a plastic operation upon the relaxed vagina. In view of the possibility of dystocia due to the uterine suspension occurring later, it would be better to correct the displacement by means of Alexander's or Gilliam's operation.

Hypertrophic elongation of the cervix is occasionally observed in childhood and is sometimes, although not necessarily, associated with descensus of the uterus, being probably an important cause of the displacement. The condition is sometimes mistaken for simple prolapsus, but on careful investigation it is easily recognized. Partial amputation of the cervix is the appropriate treatment.

Congenital split of the cervix is described by Noble, Penrose, Edwards, and others, and is frequently associated with ectropion of the cervical mucosa, or so-called erosion. The condition is not important during childhood, but in later life it may be of medico-legal interest. It may be distinguished from lacerations due to

¹ Néel: Thèse, Bordeaux, 1904.

childbirth by the absence of scar tissue, while further proof of its congenital nature may be found in the virginal condition of the outlet.

Infantile hemorrhage is divided by Busey¹ into three groups. In the first and most frequent form the hemorrhage occurs periodically and is associated with the external signs of premature puberty; in the second there is irregular hemorrhage for a brief period, but not beyond the twelfth to the eighteenth month; the third variety occurs during the puerperal month, usually between birth and the sixth day, and subsides spontaneously. While cases of idiopathic hemorrhage are not rare and have no deleterious effect upon the child, every case should be carefully investigated, as irregular hemorrhage may be due to a new growth of the vagina, uterus, or ovaries, and in many cases of supposed precocious menstruation the hemorrhage and unusual development of the external reproductive organs are due to the presence of ovarian tumors, especially ovarian sarcoma, and cease after the removal of the growth.

Endometritis.—The frequency with which the cervical and uterine mucous membrane become infected as a sequela of infantile gonorrheal vulvovaginitis is still under discussion. Sanger considers it a relatively frequent event, and Dind states that the cervix and urethra are the seats of election for gonococci. Young, on the other hand, believes that the cervix is seldom infected and found only two instances out of twenty cases. In a few cases the vaginal discharge was found to come entirely from the os uteri. Clinically the disease pursues a mild course, and unless complicated by extension to the tubes and peritoneum, is chiefly characterized by the purulent discharge, which, by means of a suitable speculum, may be seen exuding from the cervix. Rest, tonics, and the treatment of the vulvovaginitis are usually the only indications. In an obstinate case of endometritis persisting after removal of the pus tubes, Bidwell curetted the uterus, after which the discharge ceased. The use of the thermocautery in obstinate cases of cervical endometritis in children would probably be as successful as it is in adult cases, but so far as I am aware it has not been tried.

Tuberculous endometritis in childhood is usually associated with disease of the tubes, and I have not been able to find any cases in which the disease appeared to be primary in the uterus. The disease may be limited to the endometrium or may infiltrate the musculature also. In several recorded instances of the disease the uterus was converted into a large pear-shaped tumor filled with caseous material. The cervix is rarely invaded. In one young girl of fifteen years, observed in Kelly's clinic, a papillary growth attached to the cervix was found on microscopic examination to consist of hyperplastic tuberculous tissue.

Tumors of the uterus are exceedingly rare under eighteen years. The majority of the reported cases were malignant. Cervical polypus is occasionally observed in young girls, and a case of uterine myoma in a girl of eleven years is referred to by H. Spencer.

Malignant Tumors.—Carcinoma of the uterus may be primary or secondary.

¹ Busey: Trans. Obst. Soc. of Washington, 1889-90, vol. iii, p. 25.

Laidley described a case of primary carcinoma of the uterus in a child two and a half years old, and Ganghofer an instance in an eight-year-old girl. Other cases have been observed at nine, eleven, and thirteen years. A case of primary sarcoma of the uterus in a three-year-old child was reported by Depage.¹ The child was operated on for a small cervical tumor which was diagnosed as a fibroma. The growth recurred in six months and a vaginal hysterectomy was then performed. Six weeks later a rapidly growing tumor entirely filled the pelvis. Microscopic examination revealed a small round-cell sarcoma. Zweifel² did a vaginal extirpation for round-cell sarcoma of the uterus in a child of thirteen years. Curtis³ operated on a child twelve months old for grape-like sarcoma of the cervix and vaginal vault. Death occurred the following day. It is possible that in this case the growth was primary in the vagina.

DISEASES OF THE UTERINE TUBES AND PARAMETRIUM.

Hernia of the tube may be congenital or acquired and may occur with or without the ovary. Garrigues⁴ collected forty-three cases of hernia of the tube alone; nine of them were congenital. Acquired hernia is more frequent, but is rare in childhood. The most frequent form is the inguinal. The herniated tube is subject to external injury and is also liable to become strangulated. Almost all cases demand early operation. If the tube is normal it should be returned to the abdomen, but if extensive adhesions are formed, or if the tube is much diseased, it should be removed.

Hyperemia and hemorrhagic infiltration of the tube in children occasionally occur as a sequela of the acute exanthemata, typhoid fever, cholera, and although usually of a slight grade, fatal cases have been observed (Hennig). Mechanical obstruction to the tubal circulation is rare in childhood, but is occasionally found in ovarian tumors with twisted pedicle which includes the tube. Such a case in a new-born infant is described by v. Franqué.⁵ Hematoma of the tube in cases of gynatresia followed by retentio mensium is described above.

Salpingitis in children is with few exceptions due to infection with the gonococcus or tubercle bacillus. There are several cases recorded of acute tubal inflammation in young girls where the infection was secondary to appendicitis, and the appendix should always be suspected in pelvic inflammation in childhood when a gonorrheal vulvitis is not found.

Gonorrheal salpingitis and localized or general peritonitis are regarded by some writers as rare sequelæ of infantile vulvovaginitis; others, notably Sânger and Hennig, are of the opinion that gonorrheal pelvic inflammation is comparatively frequent. Bidwell and Carpenter,⁶ collecting and analyzing a large number of

¹ Depage: *Cent. f. Kinderheilk.*, 1902, Bd. vii, S. 103.

² Zweifel: *Cent. f. Gyn.*, 1884, Bd. viii, S. 401.

³ Curtis: *Obst. Trans.*, London, 1904, xiv, p. 320.

⁴ Garrigues, A.: "Les Hernias de la Trompe Uterine," Thèse, Paris, 1904.

⁵ Von Franqué: *Zeit. f. Geb. u. Gyn.*, 1900, Bd. xliii, p. 257.

⁶ Bidwell and Carpenter: *Brit. Jour. of Children's Diseases*, vol. i, No. 10.

reported cases illustrating the complications of gonorrheal infection in children, find that pelvic inflammation is not infrequent, but it appears usually to run a benign course. Galvagno¹ thinks that the peritoneum in childhood is more susceptible to gonorrheal infection than in adults, but that the condition in children is rarely diagnosed. The course of the disease is rather mild and the prognosis fair. Galvagno found 35 cases of chronic or subacute peritonitis recorded, with a mortality of about 20 per cent. Out of 24 cases of diffuse gonorrheal peritonitis in the literature, 10 were in children.

The *clinical history* of pelvic inflammation in older children corresponds to that in adults. In infants and young children, unless the presence of a vaginal discharge has been noticed, a diagnosis is seldom made. The usual symptoms are pain in the lower abdomen, dysuria, and painful defecation, associated with general malaise and more or less fever. The onset of acute peritonitis is characterized by severe abdominal pain, tenderness, and distention, usually accompanied by vomiting. The temperature is often high, the pulse rapid, and the characteristic peritonitis facies more or less marked. The presence of a vaginal discharge, which may have appeared a few days before the abdominal symptoms or occurred simultaneously, indicates the origin of the disease. In many cases in children a gonorrheal arthritis has developed before or at the same time as the abdominal affection.

The *treatment* should always be expectant. The large majority of cases terminate in complete recovery without operation. Rest in bed, ice on the abdomen, small doses of opium, and laxatives are the appropriate treatment. Galvagno advises also the administration of potassium iodid. In favorable cases improvement of the acute condition is soon noticeable. If no improvement is perceptible, operative treatment may be demanded.

Tuberculosis of the Tubes.—In children, as in adults, the tubes are the favorite seat for the localization of pelvic tuberculosis. H. Brüning² reported 2 cases and collected 44 cases of genital tuberculosis in children, for the most part affecting the tubes. The disease is usually secondary to general tuberculosis. Allaria³ found descriptions of 19 primary cases in the literature, but in some the primary nature of the disease was questionable. There is no doubt that the disease is much more frequent than these figures seem to indicate. Many cases of pelvic tuberculosis advance without symptoms, or are masked by the symptoms arising from the pulmonary or other primary affection. The varieties of tuberculous salpingitis observed in children are the miliary and caseous forms. In primary tuberculosis the tubes are usually converted into thick, caseous pus sacs.

Symptoms.—Many cases, as I have said, give rise to no local symptoms whatever. Pain, dysuria, difficult defecation, and the characteristic tuberculous temperature, may all develop. A vaginal discharge is frequently observed. A pelvic examination reveals the hard masses lateral to or behind the uterus.

¹ Galvagno: Archives of Pediatrics, New York, January, 1904, p. 72, vol. xxi.

² Brüning: Monatschrift f. Geb. u. Gyn., 1902, Bd. xvi, S. 144.

³ Allaria: Archives of Pediatrics, New York, 1904, vol. xxi, p. 710.

The *treatment* is always operative unless contraindicated by the general condition of the patient.

DISEASES OF THE OVARY.

Hernia of the ovary is frequently observed in infants and young children and may be either congenital or acquired. The inguinal variety is the most common. Other forms are femoral, ischiatic, umbilical, and through the obturator foramen. It is usually unilateral. Waldeyer has pointed out that ovarian hernia is often associated with defective development of the other pelvic organs. In 14 cases the uterus was absent or rudimentary and in 4 cases there was a bicornate uterus. Pseudo-hermaphroditism is frequently found with ovarian hernia. The diagnosis is made from the presence of a small, firm, olive-shaped body in the hernia, which is not generally painful, but is slightly tender on pressure. There is no impulse, and no variation in size when the child is straining or crying. Adhesions, torsion of the pedicle, incarceration, and strangulation are frequent complications. All cases of ovarian hernia demand early operation. If possible the ovary should be saved, but in many cases it shows such advanced degenerative changes that its removal is the only safe procedure.

Ovaritis.—Inflammation of the ovary is a rare sequela of gonorrheal infection in children. Its surface is frequently involved in the peritoneal exudate, periovaritis, and in some cases acute ovaritis, with or without abscess formation develops.

Tuberculosis of the Ovary.—This condition is usually associated with tubercular salpingitis, or with tubercular disease of the peritoneum. In a case described by Pillaud¹ both ovaries, in a child of five years, were tubercular, while the other pelvic organs were normal. The left ovary communicated with the rectum by an irregular aperture the size of a 50-centime piece. In several cases of tuberculosis of the pelvic organs in children the ovaries have been converted into large caseous abscess sacs, sometimes as large as an orange.

Tumors.—Ovarian tumors in childhood comprise all the varieties found in adults, with the difference that certain tumors are relatively more common in children while others are more frequent in adults. Moreover, in infants and young children certain varieties, namely, dermoids and sarcomata, are chiefly found; while in older children the adenocystomata are the most frequent.

Retention Cysts.—Multiple cystic changes in the ovaries are stated by de Sinéty, Kissell, and others, to be frequent in new-born babies and young infants, but are not found in older children. O. v. Franqué, at autopsy on an infant eighteen hours old, found a rounded, bluish-black cyst of the left ovary extending almost to the umbilicus, with the pedicle twisted three times. In the other ovary there was a small follicular cyst and other follicles beginning to show cystic changes.

Cystadenomata comprise about three-fourths of the ovarian tumors in children

¹ Pillaud: Cited by Brouardel, Thèse, Paris, 1865.

over five years, and are occasionally observed in early childhood. The tumor may attain an enormous size, and usually develops very rapidly.

Embryomata.—Dermoid cysts comprise about one-half of the ovarian tumors of early childhood and have even been present at birth. They are often of large size and are occasionally bilateral. Malignant embryomata or teratomata, are also relatively frequent in childhood. In Römer's case, operated upon at twenty months,



FIG. 405.—LARGE OVARIAN DERMOID IN A GIRL SEVEN YEARS OLD (Dandois).

the abdominal enlargement was noticed at birth. Metastases are common. Secondary nodules, presenting the same structure as the primary tumor, are sometimes found on the omentum and general peritoneum, but the distant metastases are usually pure sarcomata. Pick¹ found a tumor in a girl nine years old which at first was regarded as a medullary sarcoma, but on careful examination later was discovered to be an undoubted teratoma containing endodermal, mesodermal, and ectodermal parts, and especially characterized by the presence of typical Langhans' cells and syncytium. This writer, as well as Landau, believes that many of the supposed carcinomatous and sarcomatous growths in young individuals belong to a well-defined class which they designate epitheliomata chorioectodermale.

Sarcomata form a large proportion of tumors in early childhood and are sometimes congenital. The majority are of the small round-cell variety, but spindle-cell tumors, fibrosarcoma, and endothelioma have been described. The tumor is

usually unilateral, but is sometimes bilateral, and in cases in which after removal of the growth a second tumor developed in the opposite ovary, a microscopic focus was probably present at the time of operation.

Carcinoma of the ovary is exceedingly rare in children. I have found records of only 8 cases in which operation was performed for this disease in children. The

¹ Pick: Berl. klin. Woch., 1904, Nos. 7 and 8.

youngest case that I am acquainted with was successfully operated upon by Kelly in October, 1904. The history of the case is briefly as follows:

E. T., age five years, admitted to the Johns Hopkins Hospital with a history of recurrent attacks of abdominal pain dating from a fall three and a half years previously. Two months before admission it was noticed that the abdomen was swollen, and shortly afterward a vaginal discharge appeared which at first was whitish but later was discolored with blood. The child's general health was excellent. The breasts were large for her age and the pubic hairs developed. At operation a carcinoma of the left ovary, the size of a large cocoanut, was removed (see Fig. 135, p. 196). The right ovary appeared normal and was left *in situ*. The patient made a rapid recovery and six months later showed no signs of recurrence.

The *symptoms* of ovarian tumors in children in general correspond to those observed in adults. The evolution of the tumor appears to be much more rapid in childhood, and even in the case of innocent growths the child soon succumbs. On account of the relatively small space for its development, the tumor produces more marked pressure symptoms, and dyspnea is often pronounced. Malignant tumors, besides producing marked cachexia, are also prone to cause ascites. The frequent occurrence of a bloody vaginal discharge with malignant ovarian tumors has been mentioned already. When complications exist, such as torsion of the pedicle, rupture, or suppuration, the characteristic symptoms of these accidents develop. Torsion of the pedicle appears to be particularly frequent in the tumors of childhood.

Ovariectomy.—The only treatment of ovarian tumors is removal by means of abdominal section. The importance of an early operation cannot be too urgently insisted upon. When there is doubt as to the advisability of operating on account of the apparent extension of the growth, the child should be given the benefit of the doubt and an operation attempted. Permanent cure has resulted in cases where there seemed to be a hopeless extension of a malignant tumor. Care should be taken to limit the shock as far as possible, the operation being performed rapidly and the child's body kept warm by wrapping with flannel and applying hot-water bottles. The opposite ovary should be inspected, but should not be removed in the case of innocent growth unless diseased. Where the tumor is malignant there may be some question as to the course to be pursued. The large proportion of cases of cancer in which microscopic foci are found in the apparently healthy ovary (Glockner) points to the advisability of removing both ovaries in every case. Sarcomata appear to be less often bilateral, and it may be justifiable, if after explaining the risks to the parents of the child they so desire, to leave the opposite ovary if it presents no evidence of disease.



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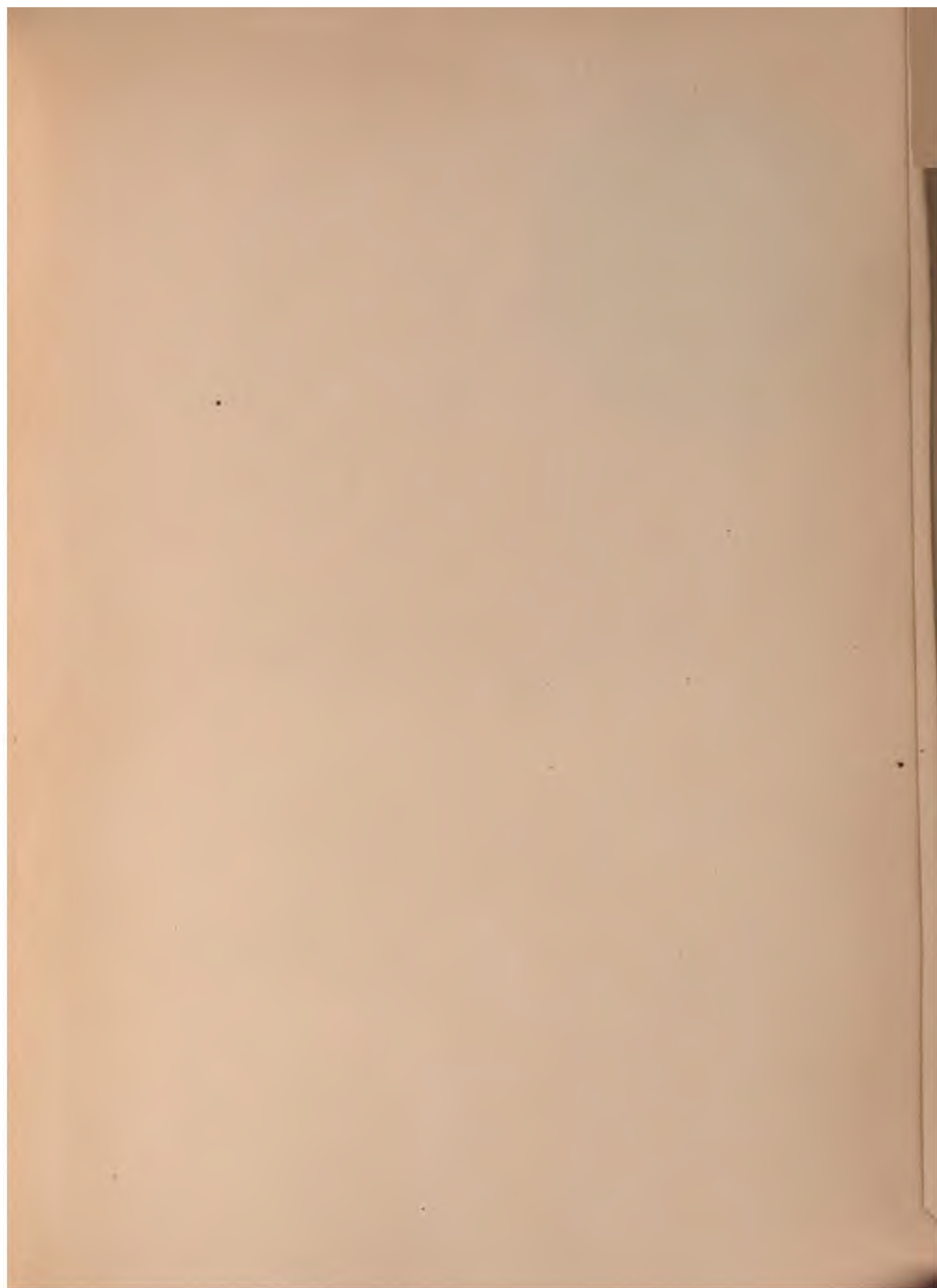
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